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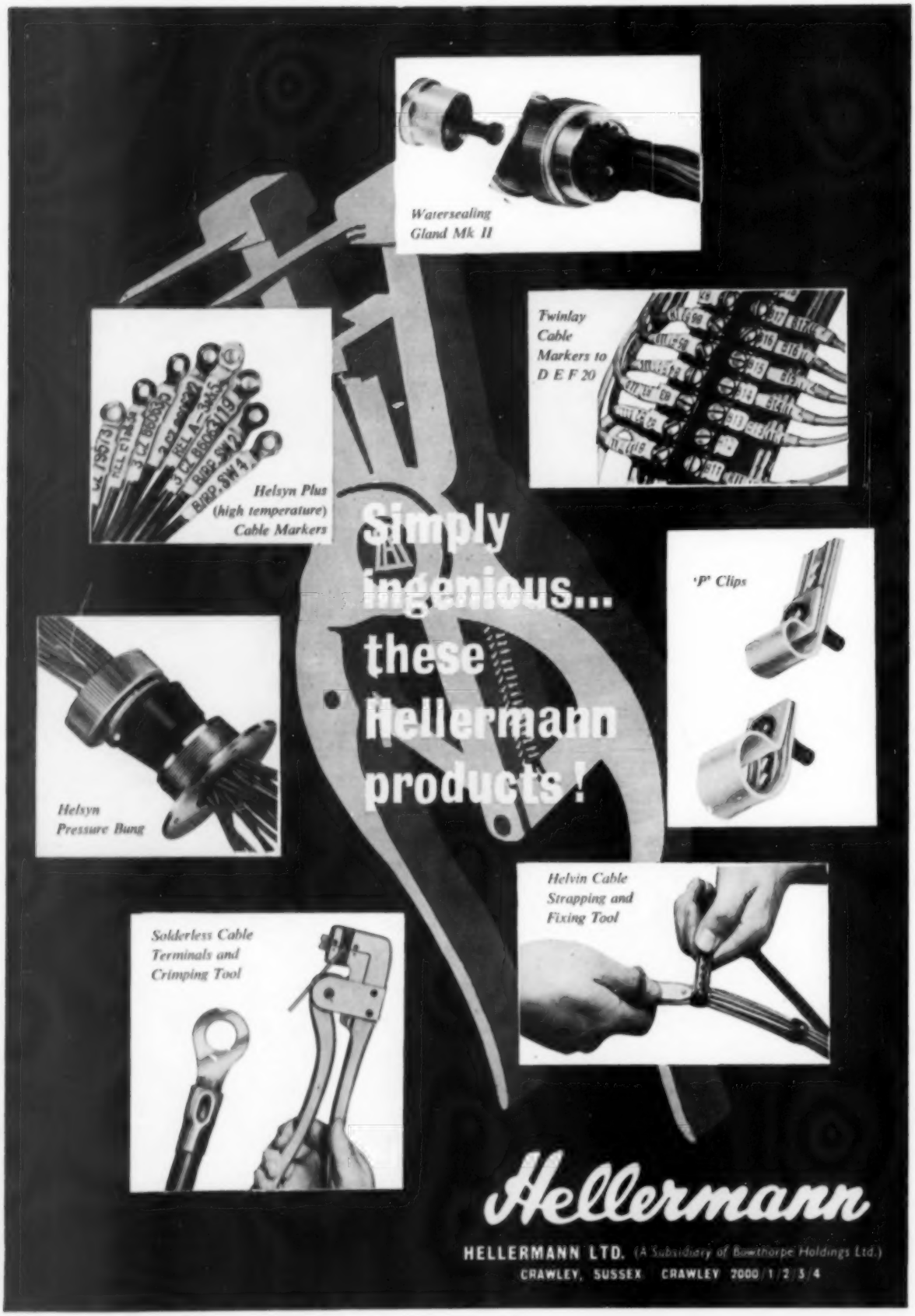
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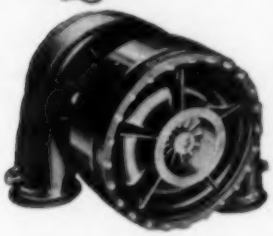

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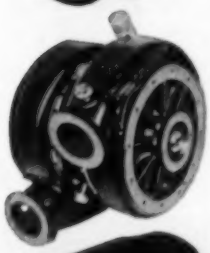

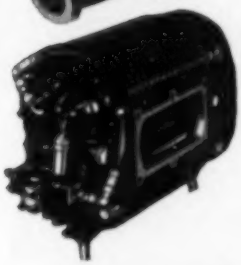

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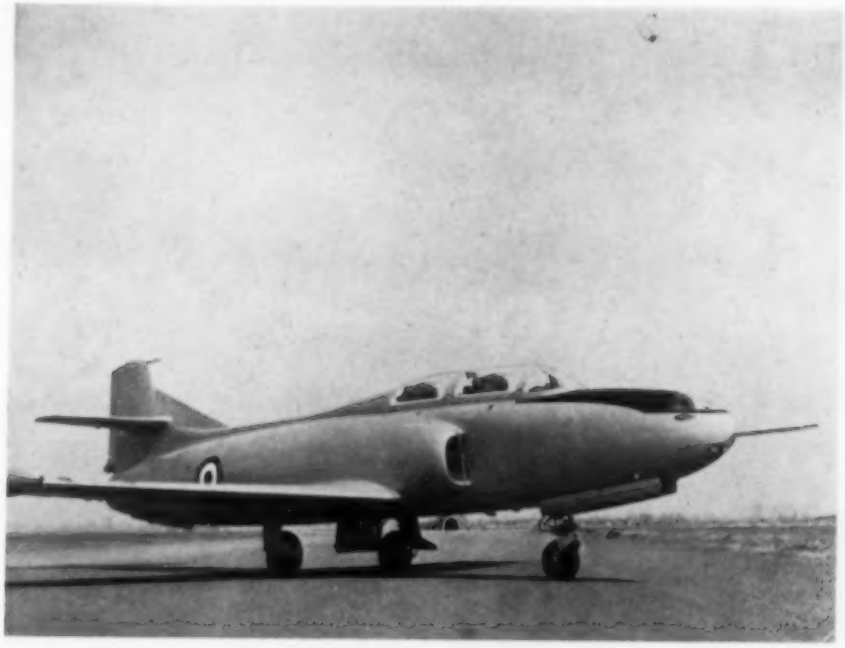

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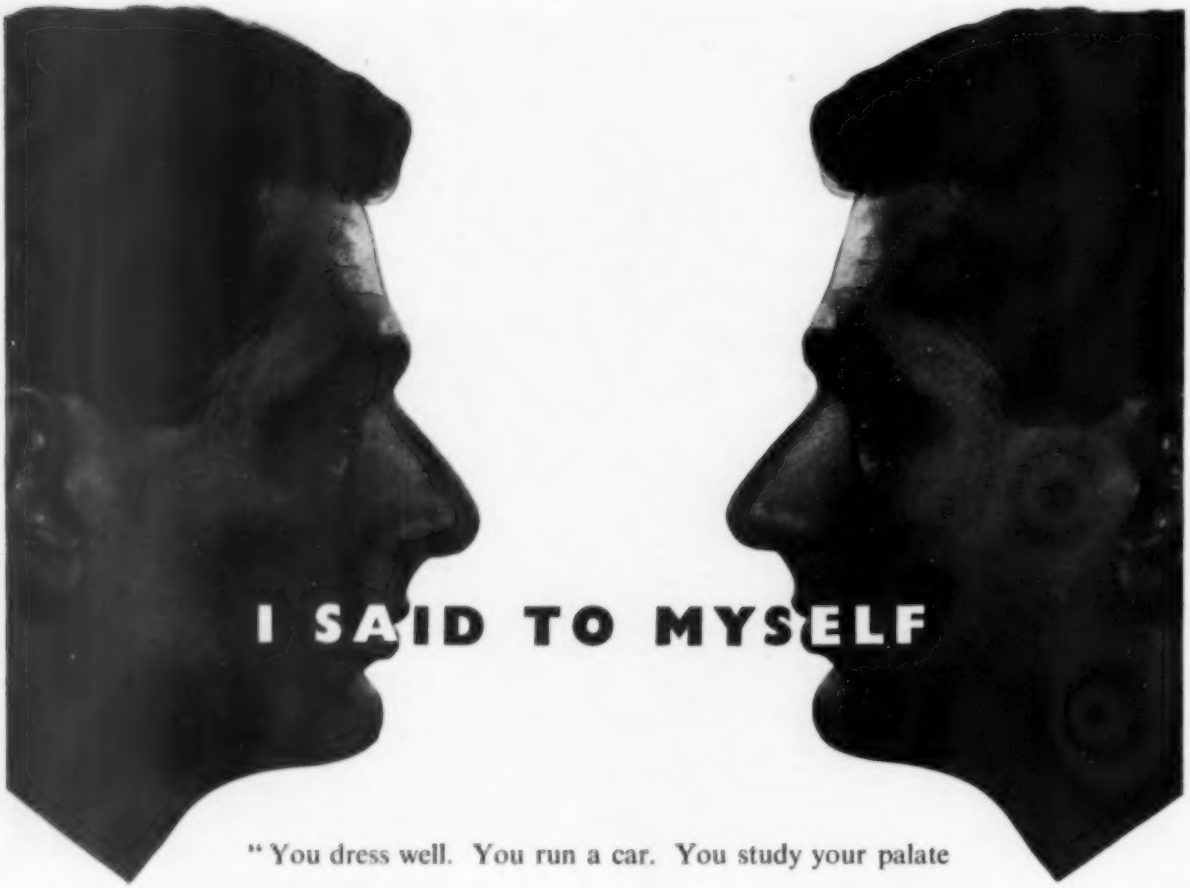

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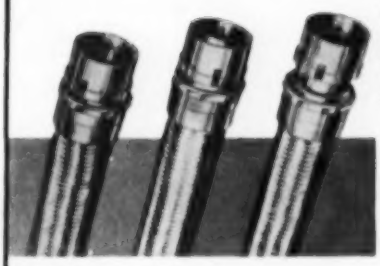

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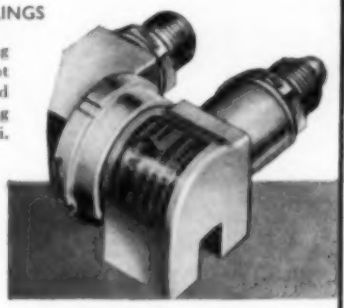

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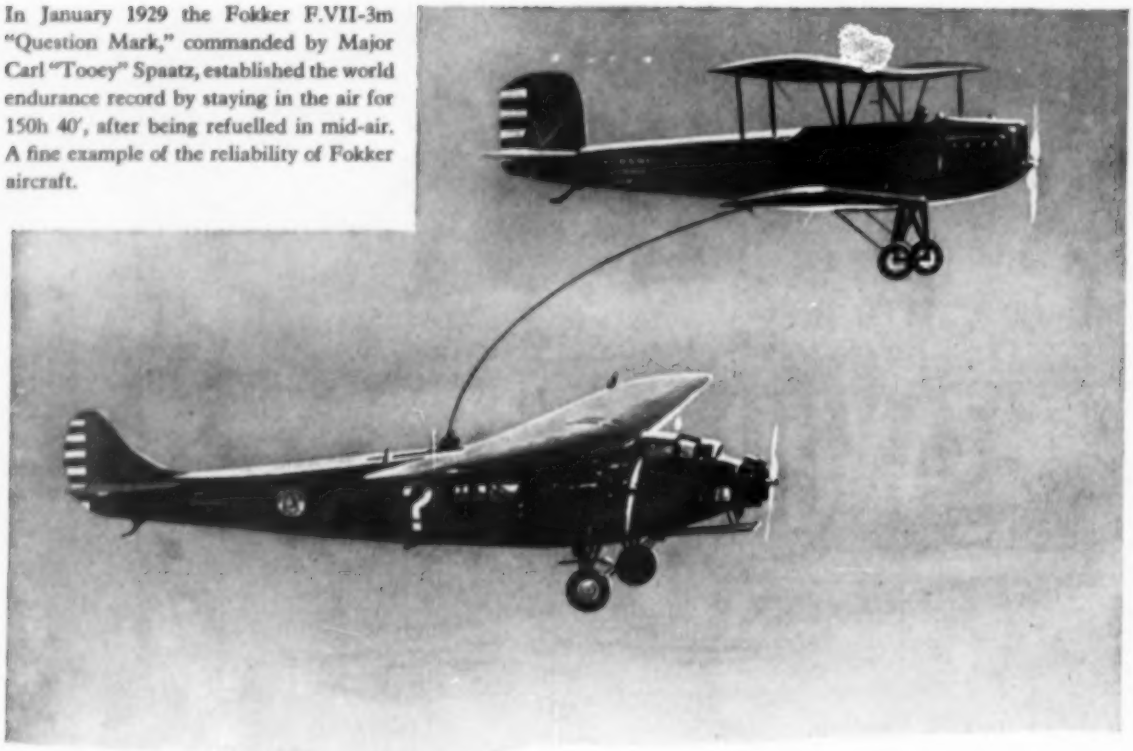

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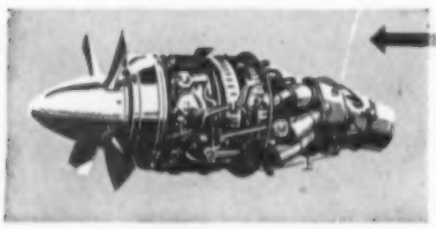

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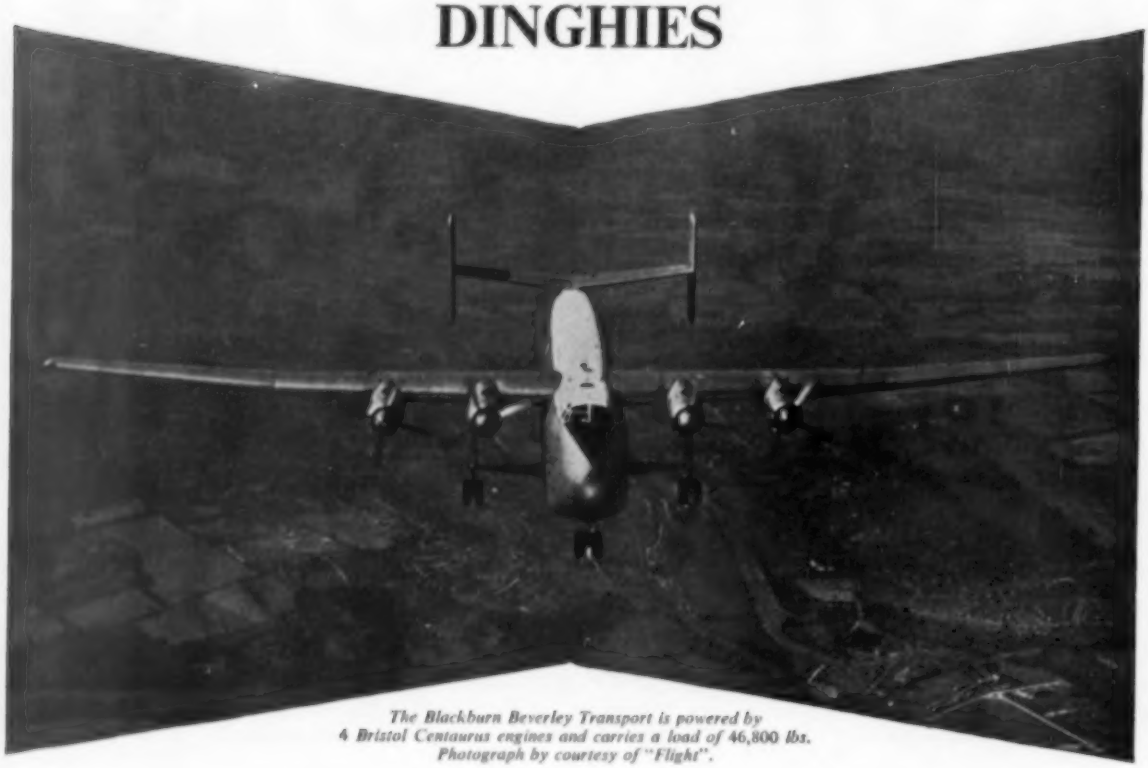

The Blackburn Beverley Transport is powered by 4 Bristol Centaurus engines and carries a load of 46,800 lbs. Photograph by courtesy of "Flight".

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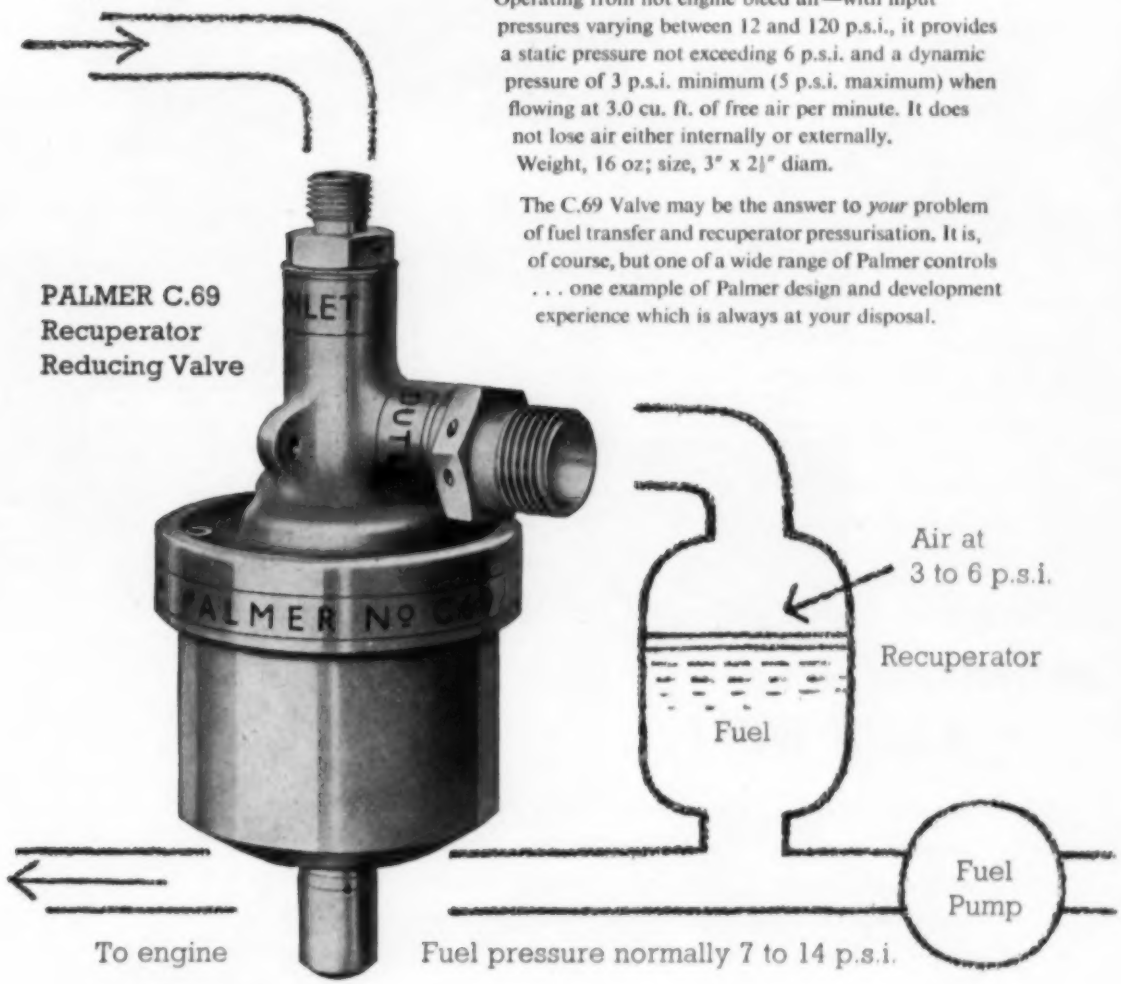

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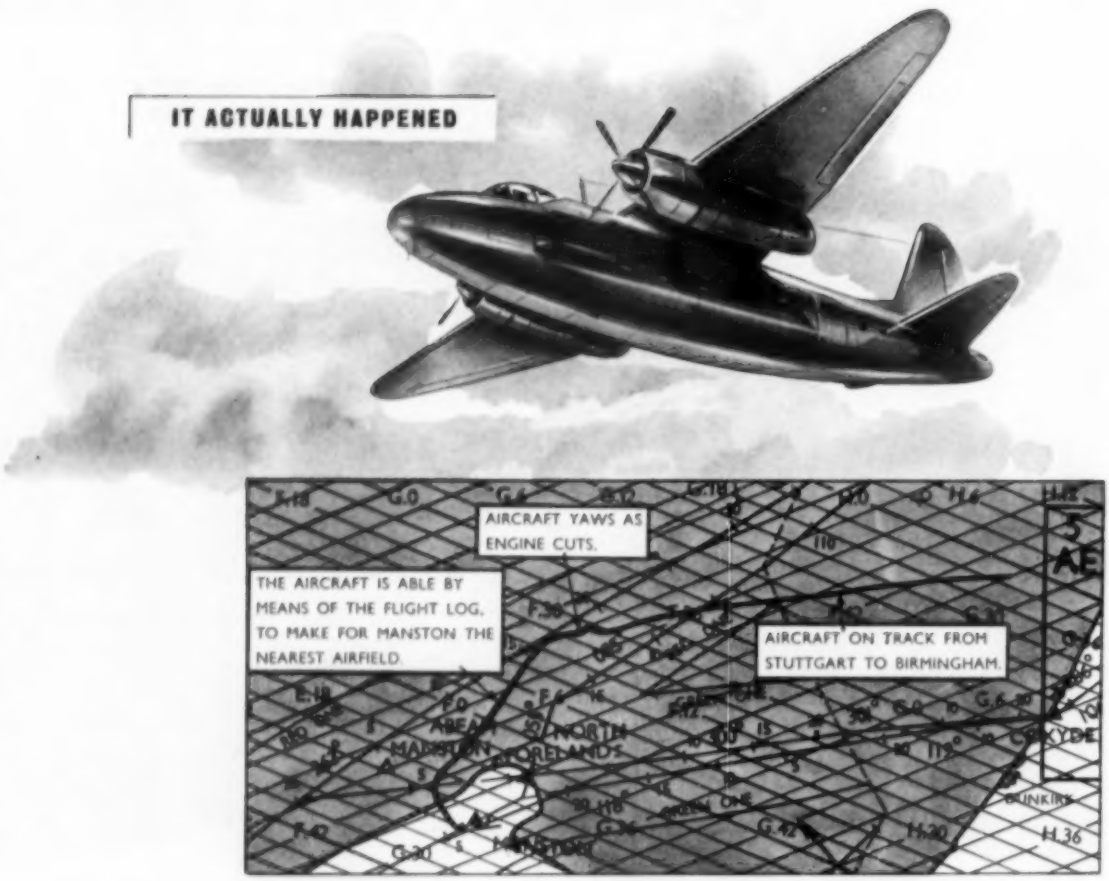
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AIRCRAFT ON TRACK FROM STUTTGART TO BIRMINGHAM.

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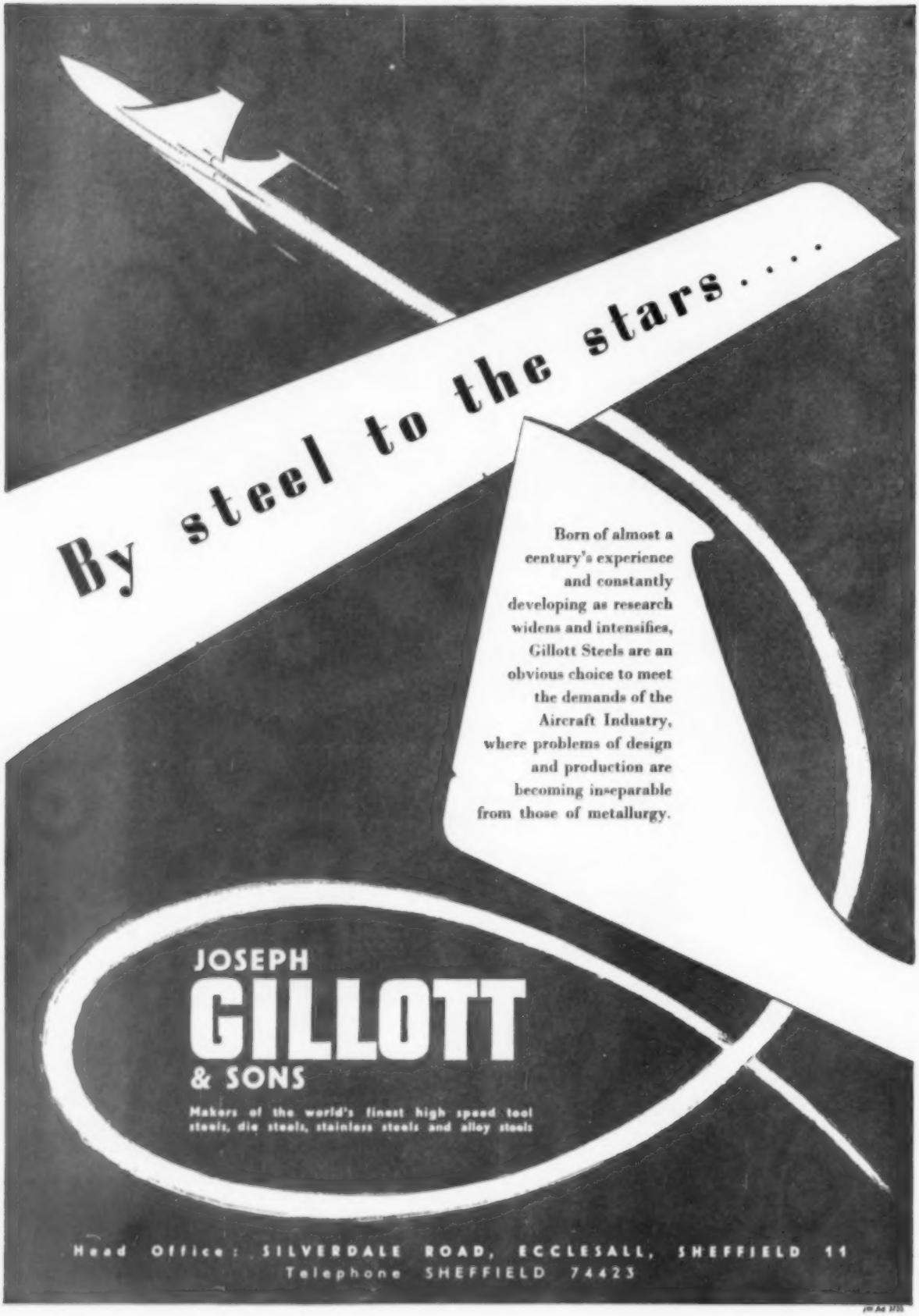
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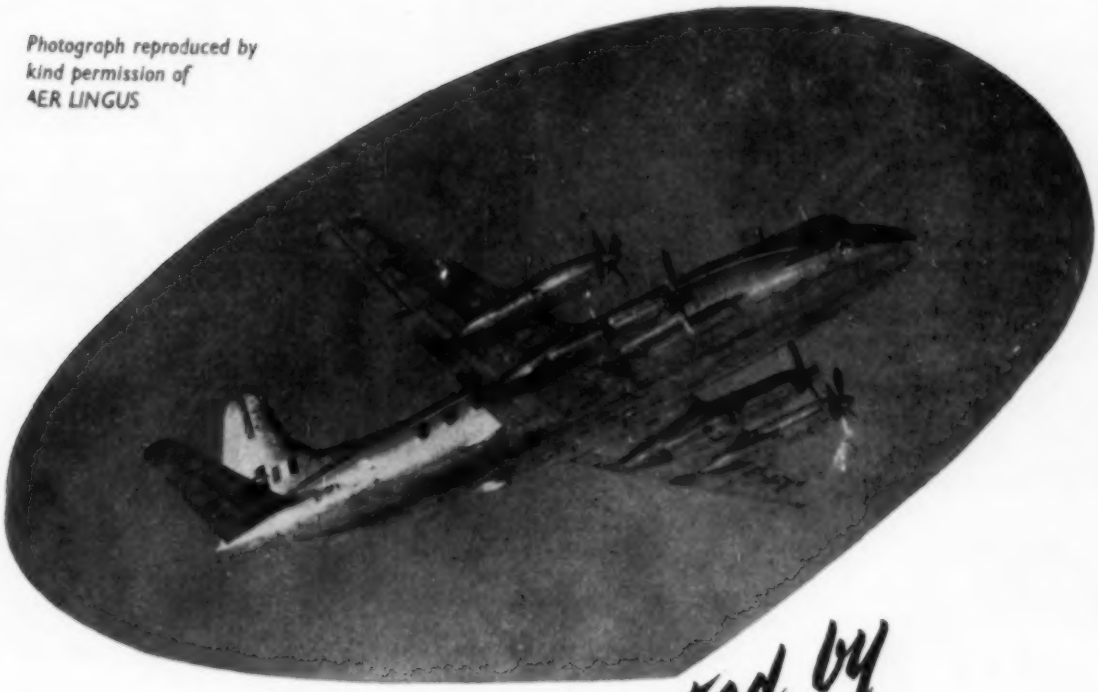

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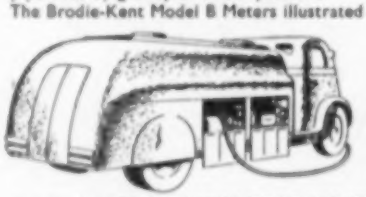

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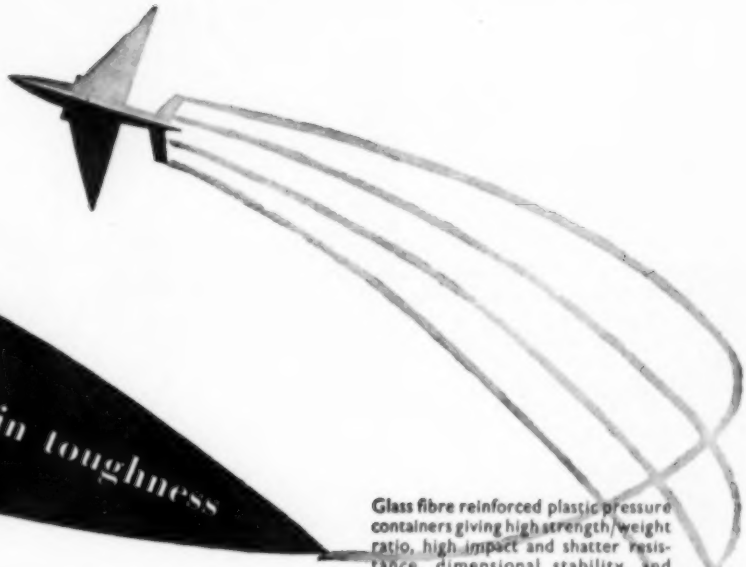

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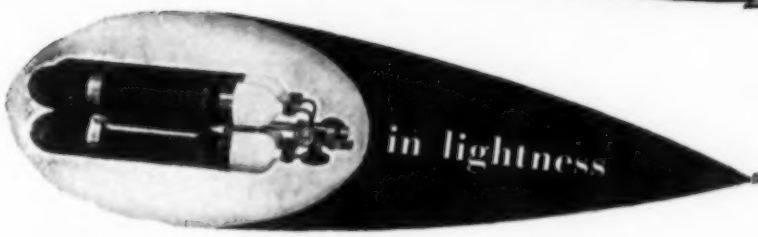

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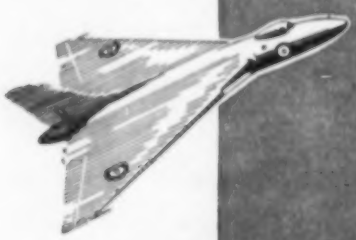

Avocet photographed by Eric Hosking.
Taken by high-speed flash with a specially constructed set giving 680 joules with two lamps at an exposure of 1/5,000th second at f/4·5

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and
AIRCRAFT ENGINEER

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EDITOR
MAURICE A. SMITH, D.F.C. and Bar

ASSOCIATE EDITOR
H. F. KING, M.B.E.

TECHNICAL EDITOR
W. T. GUNSTON

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:

DORSET HOUSE,
STAMFORD STREET,
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Telephone, Coventry 5210.

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Display *par Excellence*

THROUGHOUT last week the many thousands who daily trekked to Farnborough were treated to rare and remarkable displays of flying; it is doubtful if there has been such subtle variety among the demonstrations at any of the previous fifteen S.B.A.C. Displays. Every serious-minded visitor must have been enormously impressed by the split-second timing and control of the flying events. That not a single hitch could be detected reflects most creditably upon the organizers and pilots. Among very many flying displays we have witnessed at home and abroad none has matched the precision of that organized by the S.B.A.C. at Farnborough, and few have even approached such a standard.

It must also have occurred to those who saw the flying on each day of the week that the serviceability record of the aircraft taking part—many of which were, of course, prototypes—was outstanding; and on the days they were due, the full quotas of R.A.F. Hunters and Valiants also appeared.

Many times we were asked which demonstrations we considered best, but while in previous years we might have felt able to express such an opinion, on this occasion we do not. For the record, however, we would not hesitate to select several highlights, each equally significant in its way. There was Falk's spectacular rolling of the Vulcan bomber on the opening days (a B-47 has, of course, also been rolled) and Zura's stupendous handling of the CF-100—spin, falling leaf and tail slide in an all-weather two-seat fighter! Then that climb of the Bristol-Olympus Canberra, the altitude-record holder . . . and what of the spirited showing of the Widgeon helicopter and the cheeky little Fairey Ultra Light? In the wind of Friday, two Pioneers, single and Twin, took off and landed practically in their own lengths. Bangs were officially banned this year, but the low-level high-speed runs of the Hunter 6 and two-seater, in time-honoured manner, still brought forth a gasp and a nervous laugh from the crowd. Meritorious but less-widely appreciated, perhaps, were the half out-side loop by the Javelin delta and its bad-weather display on the Sunday, and the terrific turns by Tennant in the Gnat after his high-speed runs.

This list is far from complete and, in fact, it would be true to add that not a single demonstration reflected other than most creditably on manufacturers and pilots.

The participation of the R.A.F. proved to be a pleasant innovation and the superb formation work of the Hunter aerobatic team will be long remembered and quoted. It is to be hoped, even so, that the R.A.F. may decide to stage an occasional full display of its own, a modern counterpart of the Hendon displays of years ago.

What Next?

The frequency with which aviation predictions prove wrong is such as to discourage all crystal-gazing. It is at least five years since we were told that the last group of piloted intercepters had been designed and were on the way; yet new ones are still being specified. Jet engines were going to be much simpler than piston engines; well, . . . Then again, piston engines, except in the very smallest sizes, were going to die out; yet it will not have escaped notice that Alvis Leonides radials powered 25 per cent of all aircraft in the S.B.A.C. show—admittedly with helicopters included. Were not turboprop transports going to be by-passed in favour of jet designs? Yet today the turboprops are finding increasing favour and jet airliners themselves are turning to the by-pass!

We note that Mr. J. J. Parkes, in his S.B.A.C. presidential address, mentioned two quite different matters concerning the future. He said that only a bold man would predict an indefinite future for the high-altitude single-seat fighter, and that this country must greatly increase its home market for large airliners: "We must make more use of air transport in every way if we are to be builders and exporters of large airliners." These two subjects are, of course, closely linked, particularly if we accept that the beginning of a production change-over from predominantly fighting aircraft to those for civil and military transportation is near. In fact, to miss a single move now in such a competitive game may be to lose our foothold for a generation. Thus it may be a case of whether the country can afford *not* to take this or that step rather than whether it can afford development of this or that new transport aircraft. We must strive to produce a winner in each class and at the same time to keep an alert eye on price and timing.

FROM ALL QUARTERS

HIS LEVEL BEST: Col. Horace A. Hanes with the F-100C Super Sabre in which, as related below, he raised the world's speed record—subject to confirmation — to 822.135 m.p.h.

First Supersonic World Speed Record

A NEW world speed record has been claimed for Col. Horace Hanes, U.S.A.F., who twice flew a North American F-100C Super Sabre over an 18 km course over the Mojave desert at an average speed of 822.135 m.p.h. The height at which the attempt was made has not been disclosed, but is reported to have been about 40,000ft. Speeds for each run were 870.627 m.p.h. and 773.644 m.p.h. (M = 1.32 and 1.172).

The flight was made on August 20th, but was not announced until September 3rd, at the National Aircraft Show at Philadelphia. Until official confirmation is received, the present record, set up by Lt-Col. P. Everest in an F-100A almost two years ago at a speed of 755 m.p.h., still stands.

V.1000 "Under Consideration"

REPORTS that the R.A.F. is reconsidering its order for the Vickers 1000 jet transport were partially endorsed in a guarded statement made last week by the Ministry of Supply. The statement said: "The future of the V.1000 in its military and civil forms is under consideration in the light of the probable performance of the aircraft and the general transport aircraft situation here and overseas." Sir Miles Thomas, chairman of B.O.A.C., said recently that his Corporation was awaiting a proposal from Vickers on the V.C.7, the projected civil version of the V.1000.

The R.A.F. order for the V.1000 was officially announced this year in the Memorandum to the Air Estimates. According to an unconfirmed newspaper report, the number of aircraft involved is six. A prototype is well advanced in construction at Wisley, though it has not yet been officially stated whether production has begun. Powered by four Rolls-Royce Conway by-pass turbojets in buried installations, the V.1000 is designed to cover long ranges at high subsonic speeds. The civil version would be capable of carrying 100-150 passengers, and of making the Atlantic crossing non-stop in both directions.

Cumberbatch Trophy for Silver City

FOR "magnificent work on the cross-Channel air ferries," Silver City Airways have been awarded the Cumberbatch Trophy by the Guild of Air Pilots and Air Navigators. The trophy, which is awarded annually for outstanding contributions to or achievements in air-transport safety, will be presented to A. Cdre. G. J. Powell, Silver City's managing director, on November 4th.

The award marks eight years of operation, involving well over 60,000 Channel crossings, without an accident resulting in injury to a passenger.

Britannia Proving Trials Begin

COMMANDED by the flight superintendent of B.O.A.C.'s Britannia fleet, Capt. A. S. M. Rendall, Britannia G-ANBC set off from London Airport last Friday on the first of a series of pre-service proving flights. Previous overseas flights by Britannias have been operated by Bristols to obtain measurements of basic performance under high-altitude, high-temperature conditions. Aboard 'BC, which is the third production series 100, were 52 crew-members and observers from B.O.A.C. and Bristols.

Johannesburg, destination for the first proving flight, was reached in 20 hr 21 min flying time in three stages with refuelling stops at Cairo and Entebbe. No attempt was made to establish fast times, the average speed for the total distance working out at about 305 m.p.h.

The outward flight was delayed by "crazing" of the co-pilot's windscreen some 200 miles out of Cairo late on Friday night. The aircraft turned back to Cairo and a replacement panel was flown out by B.O.A.C. scheduled service on Saturday; it was fitted in time for the Britannia to leave Cairo early on Sunday, arriving in Johannesburg that night. The aircraft was expected to return to London within a day or two and may have left on a second proving flight before these words appear.

The "false start" from Cairo, incidentally, involved some 2½ hr flying additional to that noted above. No great significance is attached to the windscreen incident, which did not effect pressurization.

Two Armstrong Siddeley Appointments

AS we briefly reported last week, A. Cdre. H. M. ("Toby") Pearson, C.B.E., has joined Armstrong Siddeley Motors for R.A.F. liaison duties. Until recently he was Assistant Chief of Staff (Intelligence) on Sir Basil Embry's staff at Fontainebleau.

Before the war he spent several years as an R.A.F. flying instructor, was subsequently attached to the Peruvian Air Force, and in 1936 was sent to Madrid during the Spanish Civil War, with the nominal title of Assistant Air Attaché, Paris. At the outbreak of war in 1939 he was commanding No. 54 Sqn. at Hornchurch, and in March 1940 he became Wing Commander Training at No. 11 Group. Subsequently, as a specialist in night defence problems, he held various appointments in Fighter Command. Later he was S.A.S.O. in No. 85 (Base Defence) group. After the war he went to Lima again as Air Attaché and then to the Air Ministry as Deputy Director, Air Foreign Liaison.

A. Cdre. Pearson.

F/L. Frost.

Also briefly mentioned in these columns last week was the appointment, as Armstrong Siddeley chief test pilot, of F/L. Thomas Peter Frost. Now 32 years of age, F/L. Frost received his flying training in Rhodesia in 1943. He was a Bomber Command pilot until 1946. He was then posted to C.F.S., and after completing his course there was appointed an instructor with Flying Training Command, where he remained until 1952. After an E.T.P.S. course he was at Boscombe Down from 1952 to 1955. During this period he carried out early flight trials on the Avro Vulcan.

The R.A.F. "at Home"

TOMORROW, Saturday, September 17th, 46 R.A.F. stations will be open to the public, in connection with Battle of Britain Week, and in aid of Service charities. To the stations listed last week should be added four in Wales and one in the Isle of Man. The full list is as follows:—

Buckinghamshire—Halton. *Cambridgeshire*—Duxford. *Cheshire*—Hooton Park. *Cornwall*—St. Mawgan. *Devon*—Chivenor. *Essex*—Debden. *Gloucestershire*—Filton, Little Rissington. *Hampshire*—Andover, Thorney Island. *Kent*—Biggin Hill, West Malling. *Lancashire*—Kirkham. *Lincolnshire*—Binbrook, Hemswell. *Middlesex*—Hendon. *Norfolk*—Horsham St. Faith. *Northumberland*—Acklington. *Oxfordshire*—Benson. *Shropshire*—Shawbury. *Somerset*—Locking. *Staffordshire*—Cosford, Lichfield. *Suffolk*—Wattisham. *Surrey*—Headley Court. *Sussex*—Tangmere. *Warwickshire*—Castle Bromwich, Wellesbourne Mountford. *Wiltshire*—Hullavington. *Yorkshire*—Catterick, Church Fenton, Leconfield, Lindholme, Norton, Thornaby. *Scotland*—Bishopbriggs, Dyce, Kinloss, Leuchars, Turnhouse, West Freugh. *Wales*—Pembroke Dock, Porthcawl, St. Athan, Valley. *Isle of Man*—Jurby.

ROBERT BLACKBURN

Mr. Robert Blackburn. This painting — by Bernard Adams — hangs in the Royal Aero Club. The first Blackburn monoplane is represented in the background.

WITH the passing of Mr. Robert Blackburn, O.B.E., A.M.I.C.E., Hon. F.R.Ae.S., chairman of Blackburn and General Aircraft, Ltd., one of the founders and leaders of the British aircraft industry has gone from the aeronautical scene. He died at Exeter on Saturday last, September 10th, aged 70; he had visited the S.B.A.C. Display on Tuesday and Wednesday of the same week. His wife and two sons and four daughters survive him.

Robert Blackburn was born on March 26th, 1885, and was trained as an engineer. The first reference in *Flight* to his aeronautical activity was: "While testing his monoplane on the Marske sands on May 24th, Mr. R. Blackburn, of Leeds, met with a mishap. He was running the machine along the beach when, through skidding into a hole, the tyre of one of the wheels came off. Mr. Blackburn at once cut off the ignition, and, as a result of the sudden stoppage, he was thrown from his seat. Fortunately, he escaped injury . . ."

The date of that paragraph was May 28th, 1910, though young Blackburn's first hop (on Saltburn sands, in his native Yorkshire) had been made in the preceding year. His original machine, sometimes known as the "flying bedstead," had been schemed in Paris, while he was in France studying aeronautical progress. It had a number of unorthodox features: notably, the pilot's feet were not used at all, the entire control being effected by the wheel. The second machine, however, was along the fairly conventional lines of the French Antoinette. After the Blackpool meeting of 1910 that machine was taken to Filey sands, where B. C. Hucks arrived in due course and took his ticket on it. (He was self-taught, as were many of the early pilots.) For several years Hucks did most of Blackburn's flying, mostly on machines built at Balm Road, Leeds.

Late in 1911 Robert Blackburn designed two all-steel monoplanes for military purposes, and in 1912 came a new single-seater for Mr. Cyril Foggen. It is this same machine which has in recent years been renovated and repeatedly flown at public and private meetings to the delight of all. These early Blackburns were sturdily constructed, but one of them would weigh less than a single airscrew of the Beverley freighter of today.

May 1914 brought a small order for B.E.s, and Robert Blackburn took over works at Olympia, Leeds, forming the forerunner of the present company that June. The number of aircraft built from 1914 to 1918 was 235, and more than 200 were produced by sub-contractors in the Leeds area. Blackburn types of the war years included the "T.B." and "G.P." twin-engined, twin-float biplanes, the Kangaroo twin-engined landplane, and a triplane single-seat fighter. First of the naval torpedo carriers was the Blackburd of 1918; later came the Swift, Dart, Ripon, Baffin and Shark. Types of the inter-war years are too numerous to detail, but they included flying-boats, landplanes, carrier-borne machines for a variety of purposes, and floatplanes. Soon after the war the works were moved to Brough, and it was there, in 1924, that the great Cubaroo, the largest single-engined machine of its day, took the air. Most famous of the flying-boats was the three-engined Iris, and at the other end of the scale the Lincock light fighter (the Gnat of its day) demonstrated an excellent performance. The Roc and Skua were the first of the "modern" Blackburns and to a Skua fell the distinction of destroying the first enemy aircraft of the 1939-45 war.

In 1936 the Dumbarton works were established under an arrangement with William Denny and Brothers, and at about the same time the Cirrus Hermes Engineering Company, makers of light aero engines, was merged with the parent company, which then became known as Blackburn Aircraft, Ltd. World War II production included 200 Sunderlands, 1,700 Swordfish, and a sizeable quantity of Barracudas. Modifications were made on 4,000 American naval aircraft.

In recent years, following a merger, the name of the company has been changed to Blackburn and General Aircraft, Ltd., and production of the Beverley four-engined military transport has gone ahead for the Royal Air Force. Also in hand is an ambitious programme for a rationalized range of small gas turbines under a French Turboméca licence.

In all these developments Robert Blackburn maintained a close and benevolent interest; he also did much for the industry in general; he was vice-president of the S.B.A.C. in 1945-46, and a member of the society's management committee in 1950-52. He will be remembered as a quiet and kindly man, and one who inspired devotion and loyalty among his workers.

M.o.S. Appointments

THE Ministry of Supply announces that Mr. E. T. Jones, C.B., O.B.E., has been appointed Director-General of Technical Development (Air) in succession to Mr. G. W. H. Gardner, C.B., C.B.E., who is to become Director of the Royal Aircraft Establishment, Farnborough, on November 1st.

Dr. W. Cawood, C.B.E., has been appointed to succeed Mr. Jones as Principal Director of Scientific Research (Air).

Helicopter Association Dines

A DISTINGUISHED gathering was present to hear Sir Owen Wansbrough Jones, Chief Scientist of the Ministry of Supply, propose the toast of the "Helicopter Association" at the Association's annual dinner, held at the Dorchester Hotel on September 8th. Sir Owen said that he thought the problem of making helicopters "social" was an important one. They should be well-silenced and their operation should not interfere with the rights of others. He would like to see the numbers in operation in this country greatly increased. He stressed, however, that timing was most important and that those associated with the helicopter industry should make it their business to ensure that the development of this invention was not too late to be useful.

In reply, Lord Douglas of Kirtleside, president of the Association, referred to the expanding activities—including those of his own Corporation—of a number of British helicopter operators. With a membership of approximately 500, the Association was now moving from strength to strength, but more members were still wanted, particularly technical members. Lord Douglas also announced that Mr. J. G. Weir, the Association's first president, had recently been elected to be an honorary member.

Mr. Stanley Hiller, replying to the toast of "the Guests," spoke in eulogistic terms of the outstanding advancements of the British helicopter industry which were in evidence at the S.B.A.C. Show. The rotating-wing field, he said, was likely to see further expansion in the near future with the development of new principles and the appearance of unconventional rotorcraft.

Mr. C. H. Tucker

Mr. Tucker.

WE learn with regret of the sudden death in Sydney, New South Wales, on September 6th, of Mr. Claud Henry Tucker, O.B.E., director and general manager of the Bristol Aeroplane Company (Australia) Pty., Ltd. A Londoner, Mr. Tucker joined the parent company in 1942 as business manager of the engine division's shadow factory at Corsham and in 1946 moved to Weston-Super-Mare to take up a similar appointment when the company's factory there changed over from the production of Beaufighters to the manufacture of aluminium buildings. When the Bristol Aeroplane Company (Housing), Ltd., was formed later that year, Mr. Tucker was appointed secretary and subsequently became a member of the Board. He was appointed general manager of the newly-formed Australian company in 1952 and became a director this year.

FARNBOROUGH FINALE

Six-figure Crowds at the Week-end

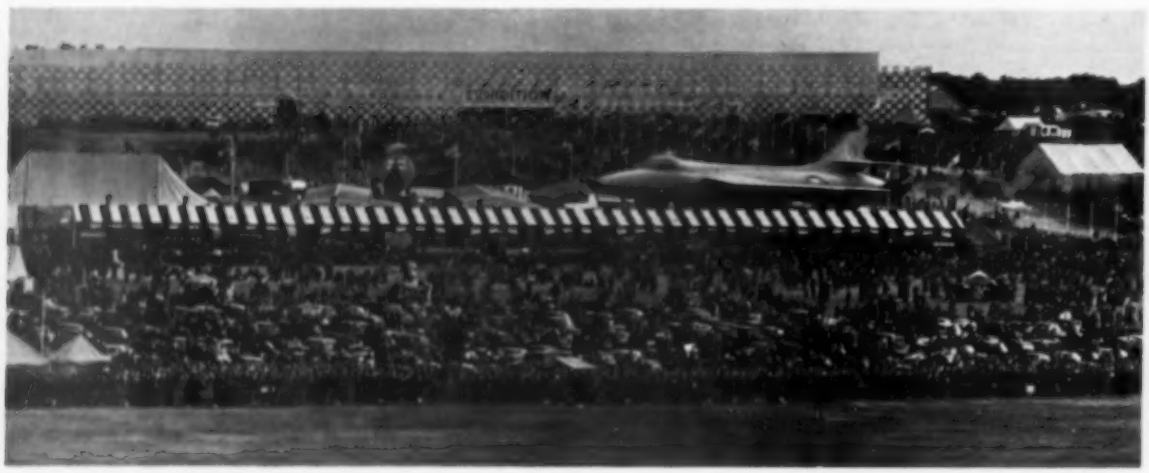
SOME 300,000 people attended the 16th S.B.A.C. Flying Display and Exhibition, which concluded on Sunday last, September 11th. Attendances on the four guest days—Monday to Thursday of last week—totalled about 60,000, of whom at least one in ten were overseas guests. Friday's crowd numbered 25,000; on Saturday the total was stated to be 112,006, despite poor weather on Sunday, the final public day, an attendance of 102,000 was recorded.

The many distinguished visitors to the Show included the Prime Minister, Sir Anthony Eden, who arrived by helicopter on September 6th, and left that evening by Avro Vulcan, and Prince Bernhard of the Netherlands, who came in to nearby Blackbushe the same day, piloting his own DC-3.

Except for the absence of the English Electric P.1 and Fairey Delta, the weekend flying programme was essentially as presented during the week. As a public spectacle, the display was perhaps slightly less effective than its predecessors of the past two or three years. One reason may have been the emphasis on production aircraft rather than prototypes, and the comparatively small number of completely new types on show. The omission of supersonic bangs, by mutual agreement among the manufacturers concerned, detracted not at all from the technical value of the Show, but was probably regretted by many of the public. Piloting was, in general, excellent, though on occasions the demonstrations fell short of the standards of originality established at previous S.B.A.C. Shows.

From the public viewpoint, the breathtaking climb performance of the Olympus-Canberra was, once again, one of the outstanding features of the display; this event was seen at its best in Friday's and Saturday's relatively clear skies. The Gnat, too, made a great impression with its compactness, speed and extreme manœuvrability. For the public days, the Victor had something up its sleeve—a cluster of four braking parachutes, publicly shown for the first time.

The weather finally tried to stop the show on Sunday, the



final public day, but, despite a cloud base of some 700ft and indifferent visibility, the pilots and radar controllers together produced the complete programme—and made it well worth watching. Vulcan, Victor, Britannia and Valiant flew past drenched in thick veils of mist while their speedier brethren made some very low and very fast passes indeed. Ranald Porteous in the Aiglet Trainer, profiting by an early lifting of the cloud base to some 1,200ft, performed his aerobatics with

The three "Flight" photographs above, below left and below give a vivid idea of the size of the crowd—it numbered 102,000—which attended on the final day. Above, the Vulcan is seen streaming its braking parachute and (left, below—a photograph taken from an unusual viewpoint on the far side of the runway) the two-seat Hunter is making its high-speed pass. The general scene below was taken by "Flight" photographer L. W. McLaren from the Skeeter 6, flown by J. J. M. Jeffery. At top right, Sir Anthony Eden is seen entering the Avro Vulcan in which he flew after Tuesday's display.

FARNBOROUGH FINALE...

customary precision and zest, but it was left to Geoff Worrall in the Javelin to make inverted flypasts and a series of excellent rolls beneath the 700ft base which prevailed throughout the individual displays.

The President of the S.B.A.C., Mr. J. J. Parkes, said on Sunday that it had been a remarkably successful week. There were "one or two substantial orders" in the offing, and details would be announced in due course. The Show was more successful than last year's and the stand-holders had never been more satisfied.

He added that he did not think the Show should be judged by the number of prototypes seen: "We should always keep in mind that it is a business meeting and the best judges of it are the people who pay to come there, the businessmen from the other side of the world and the members who take stand-space and carry other charges."

Mr. Parkes said that he felt that we were only at the beginning of a growing export of commercial aircraft from Britain. On the Service side, too, there was the fact that countries would have to consider the replacement of equipment. He thought that our aviation industry was one of our most enduring potential export businesses and this was the last moment at which we should think of closing the Show down for a year or even abandoning it as an annual event. "At this time," he said, "we need to put more and more effort into this thing, not less. We have a whole generation of aircraft either in production or coming into production, and while more and more potential customers are coming in through the Farnborough shop door there is obviously a demand for it."

An illustrated report of the week's flying, and a review of the aircraft displayed, appears on pages 477-486.

A NOTE ON THE P.1.

FEW would quarrel with the contention that the English Electric P.1 is one of the most significant prototypes at present flying in this country. For the past year it has been kept—as far as possible—from public eyes, but last week it was brought out and demonstrated at Farnborough to (among others) many of the people who helped to create it. Unfortunately it was not seen by the multitude of Farnborough visitors last week-end who had helped to pay for it. Here, however, we are concerned not with policies but with technicalities.

The conception of the P.1 (the designation means "Pursuit 1") dates from the late 1940s. At this time the Canberra was coming into full production; and Mr. W. E. W. Petter, who had directed the design of that aircraft, left English Electric to become managing director of Follands. A new design team was established under Mr. F. W. Page, and the P.1 has been their chief concern ever since.

Most of the basic characteristics were settled inside a year, but a tremendous programme of research, such as only a company as big as English Electric could tackle, was initiated. To a considerable degree, this programme required tools which had never previously been needed, and the company set out and built a great deal of expensive equipment—including the first transonic wind tunnel of its type in the United Kingdom—solely for the P.1.

Although they might not form the optimum installation, it was decided to start off by installing two of the most powerful fully developed turbojets expected to be available, in order to make sure that flight trials would not be held up through engine difficulties. In the event, a pair of Armstrong Siddeley Sapphires was selected and attention was then turned to fitting them into the airframe. In supersonic aircraft one of the most thorny problems of all is the design of the intake and ducting. After much deliberation the English Electric team went for a direct pitot intake in the nose; and this is perhaps as good a way of doing it as any other. It is certainly best from the point of view of variation of ram recovery with angle of attack and yaw, although it results in a lot of the fuselage being occupied by "empty" ducting (and the length of the latter is itself a slight embarrassment to engine performance).

The final design of wing is both thin and highly swept, the t/c ratio seeming to be about five per cent and the leading-edge sweep angle 60 deg. There is evidence of subtle changes in profile at various points along the wing (the inner leading-edge is dropped), brought in as a result of the extensive experience gained with the Short S.B.5 aerodynamic test vehicle. It was also S.B.5 flying which led to the use of small "saw-cut" slots parallel with the incident airflow, which act as wing fences.

The S.B.5 was used to prove the low-speed behaviour of the P.1 wing, and to establish the best form of control-surface arrangement for all-round stability and handling. The S.B.5 first flew in December 1952, roughly 20 months after work upon it had started. Powered by a single Rolls-Royce Derwent, it was able to work at Reynolds numbers not greatly different from those of the P.1, and it has already been flown at sweep angles of 50 and 60 deg, with high and low tailplane mountings. Further testing is scheduled with a 69-deg wing, which may presage an even more rakish P.1.

With sweep angles of this order, distances along the P.1 wing overshadow spanwise measurements. Although the length of leading edge is of the order of 30ft on each wing, the semi-span, measured from the fuselage mould line, is only half as much. In order to obtain adequate undercarriage track a particularly neat form of main gear has been devised, in conjunction with British Messier. The stalky main leg is hinged roughly in the geometric centre of the wing and folds outward, the retracted wheels turning through 60 deg and being covered by outward-hinged doors. The nose leg retracts forwards, the wheel (single, curiously enough) turning to lie flat under the intake duct. Tyre pressure is high, each main tyre having an inflation pressure of 280 lb/sq in and a maximum dynamic load of 39,220 lb. The retracted main units do not obtrude from the thin wing.

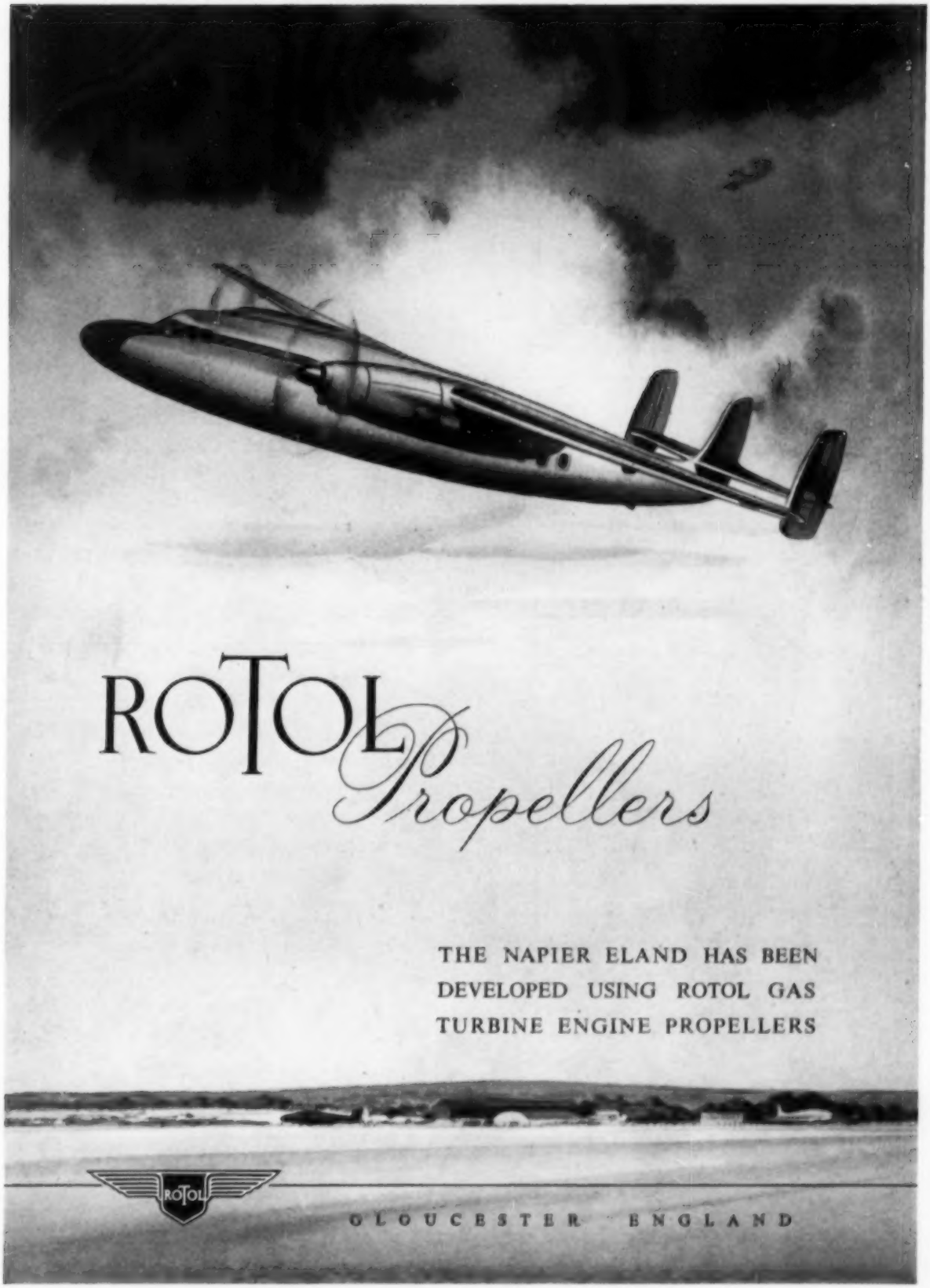
The layout of ailerons, flaps and tail is visible from the photographs presented here and previously. Obviously, all the flying controls are fully powered, the tailplane being a slab, generally similar in form to the wing but with slightly swept tips. Surprisingly, mass balance is prominent on the ailerons and rudder, and the hinges are not inset. The flaps are rather handicapped by the sweep of their hinge lines, and are accordingly simple split surfaces which do not run out to extend wing area. At full depression (of some 50 deg), they must cause considerable drag, although one could hardly expect them to remain unstalled. Flow along the flaps, and the load on the wing, must be unusual. It is remarkable that no air brakes can be seen in the photographs; certainly no such surfaces were used at the S.B.A.C. Show.

Inside the fuselage lie the two Sapphires, one mounted above, and to the rear of, the other. After studying several alternative arrangements, one of our artists has produced the sketch on p. 475. Each engine has its own set of ground-running intake doors, on each side of the aircraft; these are, on the upper engine, roughly six feet ahead of the actual engine intake, the lower doors being well forward. No afterburners are at present fitted.

A great deal of the fuel must lie in the wings, and it would seem that the P.1 must have imposed severe fuel-system design difficulties. Nevertheless, once again there is no external evidence of the tank booster pumps, although there are many access doors to powerplant equipment, particularly along the fuselage under the wing. Readers may speculate on accessory drives; both engines could hardly be geared to one drive box, and it may be that accessories are duplicated—or air-driven. Certainly cruising must be possible on one engine.

[*continued on p. 475*]

A new view of the second machine flying at Farnborough last week. Another photograph, with "everything down," appears on p. 478.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Moulding the future . . .

Flying Glass. The Blackburn 'Beverley' is a 'plane of many parts. Those shown here are complex in character, vital in the parts they play. They had to be light in weight yet as strong as steel, fireproof and chemically inert; they had to be easily and cheaply fabricated in one piece. In other words they had to be Fibreglass Reinforced Plastic.

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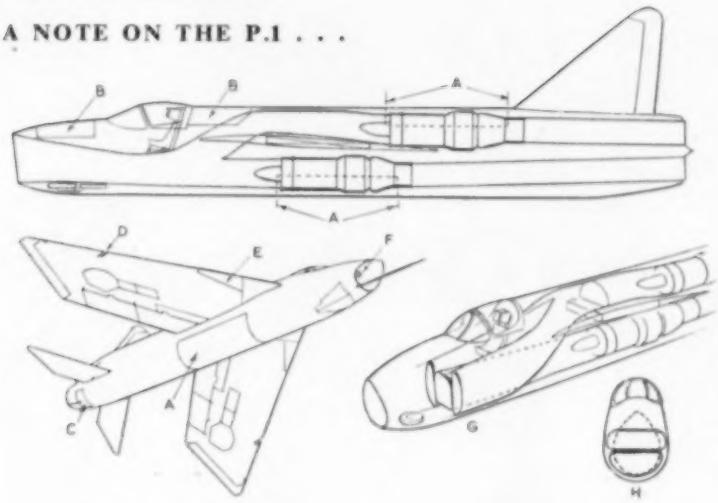
A NOTE ON THE P.1 . . .



Result of a brief study of photographs of the second P.1: A, engine-bay panels; B, equipment doors; C, braking-parachute bay with cable carried around outer skin (as on F-100); D, chordwise "saw cut" slots; E, drooped leading edge; F, camera?; G, H, alternative duct possibilities.

As the P.1 is to be a fighter, we may speculate on possible armament. Guns could be fitted, but not easily. On the other hand, missiles of most patterns could readily be carried under the fuselage and inboard and outboard of the main undercarriage. The P.1 seems to be ideal for all sorts of advanced forms of armament—although all would probably be carried externally.

The first P.1 flew on August 4th, 1954, in the hands of W/C. R. P. Beamont, the chief test pilot to English Electric. This flight, which was generally uneventful (readers are referred to *Against the Sun*, Edward Lanchbery's biography of Beaumont, just published), heralded a massive programme of testing, which will become more and more intense as further P.1s are built. In order to accelerate this work, the then Minister of Supply announced (on the occasion of the first flight of WG 760, the first prototype) "in addition to the usual prototypes, we have ordered some 20 pre-production aircraft for development trials." The second machine, WG 768, is a refined version of the first, but some of the later prototypes will be very much modified. Obviously, some will bear armament.

One might suppose that any P.1s intended to do more than about Mach 1.4 would have a pointed centre-body in the intake; and it is also fair to expect a change in powerplant at some stage, the addition of a rocket motor being not unlikely. From the original statement of the Minister it is clear that we may expect to find several more prototypes in the air soon.

Unfortunately, the P.1 prototypes are still rather restricted in speed, following the recent loss of a canopy. Canopy stressing is very difficult, and has caused trouble on both sides of the Atlantic. It is very doubtful, however, if development will be held up on this account.

As related elsewhere in this issue, the P.1 flies superbly at all speeds right down to about 150 knots. The rate of roll is outstanding and it is most unlikely that this great machine will ever be disliked or feared on account of its handling. This is, at least, a great achievement, and one which will do much to ensure the ultimate success of the type. And it must succeed, for we have nothing else like it. There are, to be sure, later and faster machines being built in Britain, but it may well be that the supersonic battleship from Preston will prove as successful as any.

W.T.G.

WESTMINSTER PROJECT ACTIVATED

ON the eve of the Show, Westland Aircraft, Ltd., of Yeovil, announced that they had initiated the design and development of a new helicopter, to be called the Westland Westminster, to meet a variety of military requirements. This name had previously been applied to a possible Yeovil-built version of the Sikorsky S-56, but it is apparent that the Westland project is a considerably more advanced design.

Power will be provided by a pair of gas-turbine engines mounted above the cabin and driving a single main rotor. The designation, or type, of power unit has not yet been revealed, but it is stated that the engine will be British and will be of the rear-drive (i.e., presumably free-turbine) layout. On the other hand, the maximum advantage of Sikorsky engineering experience is being utilized, and no doubt the rotor itself will be very similar to that employed in the S-56.

The maximum weight of the Westminster has been fixed at 33,000 lb, of which 13,000 lb will be available as disposable load, accommodation being provided for 40 passengers or 32 litters. At maximum weight, the range with maximum fuel will be 310 nautical miles, cruising at no less than 130 knots.

An artist's impression of the Westminster project.

A FILM ABOUT LINDBERGH

AT Guyancourt Airfield, near Versailles, a member of our staff spent the small hours of a recent morning watching the making of what promises to be an unusually interesting film—Warner Brothers' *The Spirit of St. Louis*, based on Col. Charles Lindbergh's autobiography, the climax of which is his 1927 Atlantic crossing.

The particular sequence being shot in a blaze of floodlight at the time of our visit was the rush of thousands of people across the airfield to welcome the pilot as the Ryan monoplane touched down. Le Bourget, where Lindbergh landed, has changed out of all recognition since 1927, so its original terminal building had been reconstructed—with considerable realism—in Guyancourt's more rural surroundings.

Two reconstructions of the aircraft have been made by Paul Mantz from drawings provided by Ryan. One is a perfect replica of the original, even to the "blind" cockpit (in *The Spirit of St. Louis* a cabin fuel tank necessitated use of a periscope); this machine was apparently intended for ground close-ups. The other, used in the air-to-air shots, has a shallow, inconspicuous windscreen and a concealed front seat from which it is flown (usually by 51-year-old Stan Reaver, one of Mantz's pilots) while "Lindbergh" occupies the rear seat. Another departure from the original is that wheelbrakes are fitted. The engine is a nine-cylinder J-5 Wright Whirlwind of 225 h.p., half-a-dozen of which are still in existence. A photograph appeared on p. 434 last week.

James Stewart, who takes the role of Lindbergh, told us that he himself had flown the Ryan for about two hours (he learned to fly in 1935, was a B-24 Liberator pilot in the war, and has kept his hand in since). He seemed particularly intrigued by 1927 landing characteristics. "When there's only a little gas in the tanks," he said, "she's so light that you're still airborne at 40 m.p.h."

Paul Mantz—who has provided other veteran aircraft for the film, such as a Liberty-engined D.H.4 and an OX-5 Curtiss Jenny—rather indignantly rejected a suggestion that his converted B-25 of Cinerama fame might have had difficulty in keeping station with the Ryan. It had already been used in a number of air-to-air shots of the early stages of the Atlantic flight.

Readers of Lindbergh's book will recall that a waterlogged field nearly put paid to his take-off. Both the film Ryans, we noticed, had been most convincingly sprayed with mud.

THE FOUR HUNTERS of No. 54 Sqn. which gave such an impressive aerobatic demonstration at Farnborough, strikingly caught against a thinly veiled sun by "Flight's" camera. On the right are the four members of the team—left to right, standing, are F/O. P. V. L. Hamilton; Captain R. G. Immig (the leader, a U.S.A.F. officer on exchange posting); F/O. B. J. Noble; in front is P/O. K. R. Curtis.

HERE AND THERE

Royal Visit to Avro

THE A. V. Roe establishments at Chadderton, Lancs, and Woodford, Cheshire, are to be visited by the Duke of Edinburgh on November 8th.

Hunters for Peru

THE first order for Hunters received from a country outside Europe was announced during Farnborough week by Hawker Aircraft, Ltd.; they stated that they had concluded with General Manuel P. Garcia, head of the administration of the Peruvian Air Force, "a substantial order" for these aircraft.

More Skyways Flights to Cyprus

THE frequency of the Skyways "colonial coach." Crusader service to Cyprus will be increased from fortnightly to weekly from October 5th. Announcing Government approval for the increased frequency, Skyways say that it "will enable agents to offer passengers greater adaptability in travel itineraries, and will also better serve the travelling public, who have usually found the service fully booked."

New Height-Record Bid?

ACCORDING to a report current during the S.B.A.C. Show, an attempt will shortly be made by English Electric to beat the 65,876ft aeroplane altitude record established recently (subject to F.A.I. confirmation) by Bristol test pilot Walter Gibb in the Olympus-Canberra. The challenger, said the report, would probably be Roland Beamont, English Electric's chief test pilot, flying a lightened Canberra P.R.9 with Rolls-Royce Avon 206s. To beat Gibb's record, Beamont would have to exceed the latest record height by three per cent, or almost 2,000ft.

Woman Instructor's Scholarship

THE Women's Engineering Society, who administer the Amy Johnson Memorial Fund on behalf of its sponsors, are offering for open competition a scholarship of £150 to aid a selected woman holder of a Private Pilot's Licence to qualify for an Assistant Instructor's Certificate. Details of qualifications are obtainable from the secretary of the scholarship committee, Miss I. J. Ferguson, 104 Holden Road, Finchley, London, N.12.

I.A.S.-C.A.I. Meeting

SOME 400 aircraft-industry engineers and executives are expected to attend the second annual joint meeting of the Institute of the Aeronautical Sciences and the Canadian Aeronautical Institute, to be held on November 3rd and 4th in Ottawa.

Bomber Station Honoured

ON September 7th, the Freedom of the Borough of Huntingdon was presented to R.A.F. Station, Wyton. The Under-Secretary for Air, Mr. George Ward, attended the presentation ceremony, when the Mayor, Councillor Kenneth Beaton, handed over to the Commanding Officer, G/C. S. G. Wise, a casket containing the scroll. This gives the station personnel the privilege of "marching through the streets of Huntingdon on all ceremonial occasions with bayonets fixed, colours flying, drums beating and bands playing."

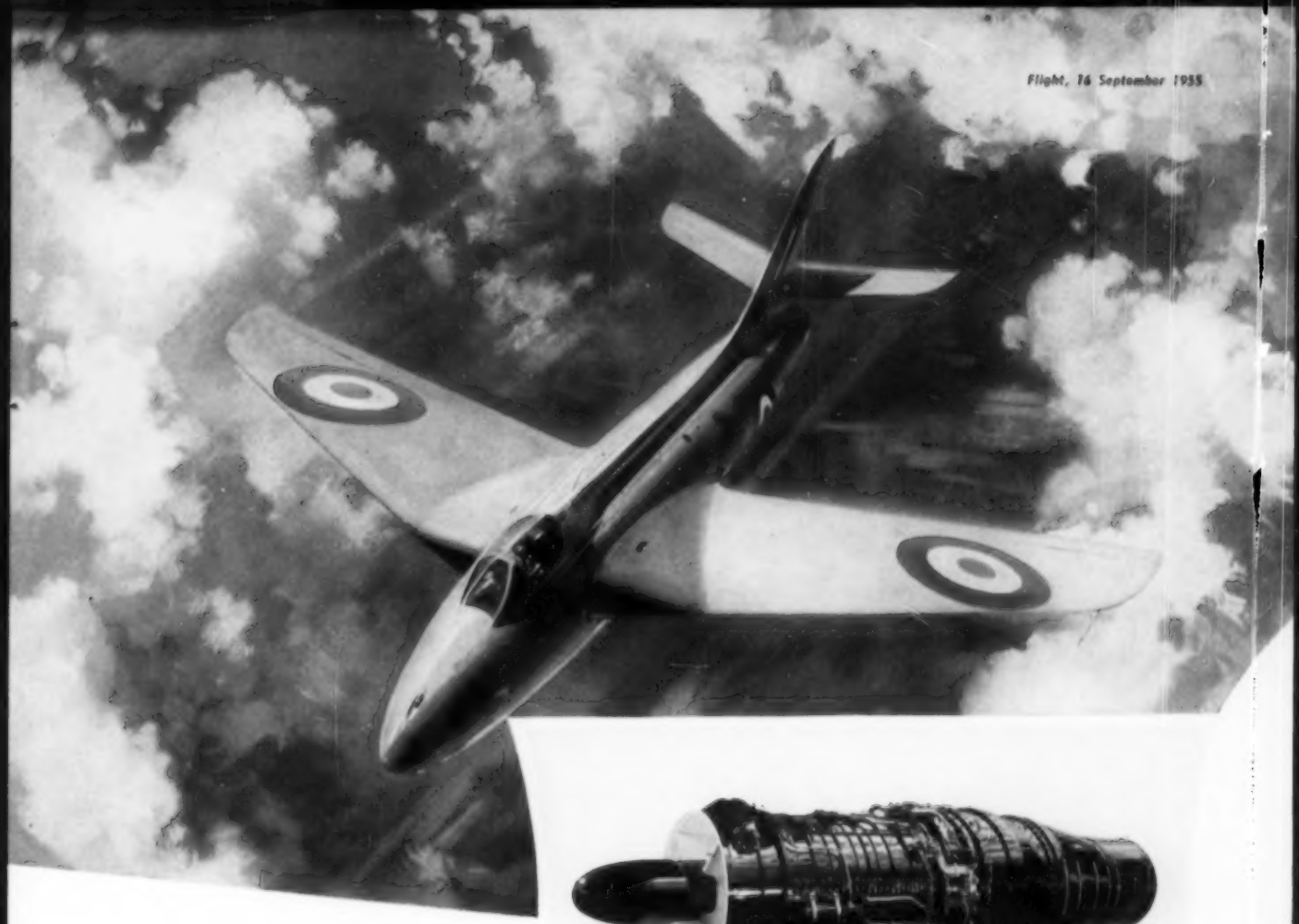
C.D. Helicopter

AT a ceremony at South Bank, London, last Wednesday, a helicopter was due to be taken over by the Home Office for a series of Civil Defence reconnaissance and communications experiments. It is a Whirlwind chartered from B.E.A.

Fortunate Escape

ONLY the pilot was injured—and but slightly—when a R.N.Z.A.F. Hastings with 25 aboard crashed at Darwin on September 9th after meeting a flock of hawks just as it was getting airborne. It is reported that the bodies of the birds choked the air intakes of all four engines and stopped them. The lack of injuries was attributed to the fact that the aircraft had rearward facing seats.

SOUND AND FURY: This dramatic photograph, taken at the launching of an English Electric "test vehicle," conveys a vivid impression of the tremendous power generated by the missile and its boosters, the flames of which can be seen. Note the flying stones.



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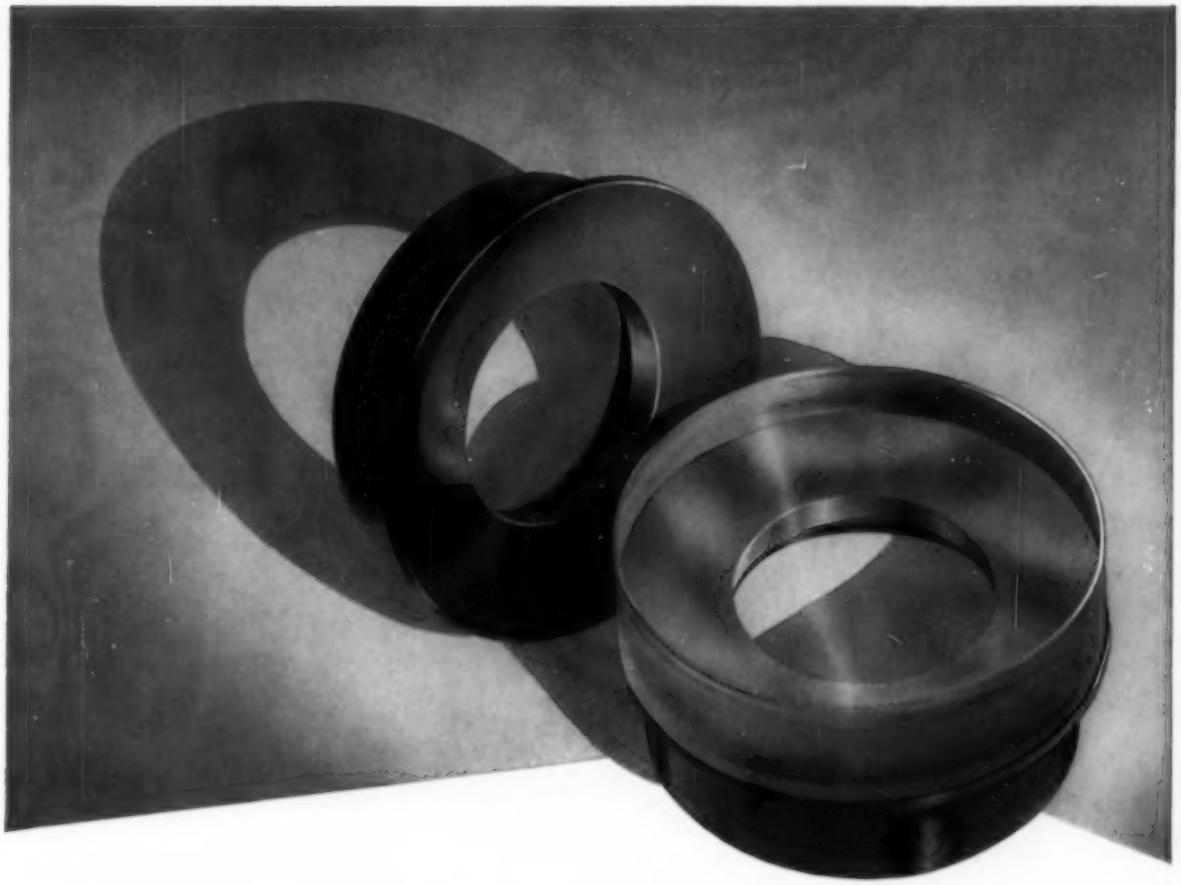

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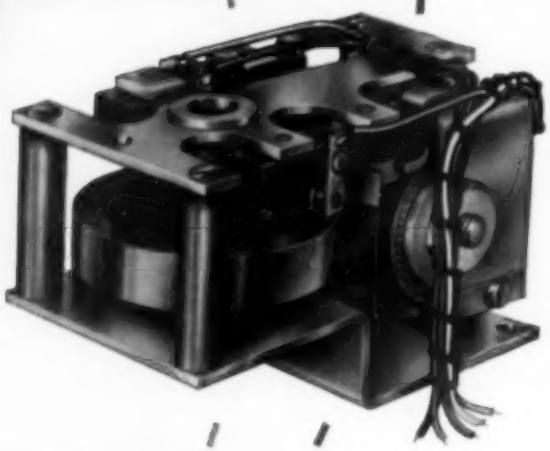

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A57

THE WEEK AT FARNBOROUGH

—*in the Air and on the Ground*

THE honour of leading the first "circus," and thus of opening the 1955 S.B.A.C. flying display, fell to the New Elizabethan, the Eland-powered Ambassador prototype. This is a significant aeroplane, because it spearheads Napier's determined drive to enter a market at present dominated by other British engine companies. Its demonstration illustrated the improved performance conferred by the 3,000 e.h.p. Eland turboprops (the aircraft is estimated to carry 1,100 lb more payload 75 m.p.h. faster than B.E.A.'s Centaurus Elizabethans) and the marked reduction in external noise level. After a steep climb-away the New Elizabethan began its fly-past with one airscrew windmilling; overhead, Randrup re-started the inoperative Eland and showed the 3-sec acceleration from idling to full power. Reverse pitch was effectively used at touch-down. The new Elizabethan should complete its trials in May 1956, when it is due to be handed over to B.E.A. for scheduled freight services.

The Gannet was represented in the flying display by a silver T.1 trainer of the type which first flew 13 months ago and is now in regular service with the Fleet Air Arm. Its swerving fly-past, with weapons-bay agape, was followed by a climbing roll and a single-Mamba approach and landing.

Interesting contrasts in test-bed demonstrations were offered by the Gyron-Sperrin and Conway-Ashton. With three Avons idling, the Sperrin sailed by comfortably on the power of a single D.H. Gyron, carried asymmetrically in its bulging port nacelle. Thrust-line equilibrium, incidentally, will be restored later this year by the installation of a second Gyron in the lower starboard nacelle. The Ashton kept all its taps on and zoomed skyward on the strength of 33,000 lb of Rolls-Royce thrust—13,000 lb of this total being concentrated in the underslung Conway, the first by-pass turbojet to be type-tested and publicly demonstrated.

Piston engines powered the second circus—a miscellany of five lighter types, led by the Armed Provost. Wearing Iraqi Air Force markings, the Provost showed with a text-book roll that two 0.303in guns and eight 25 lb bombs have little effect on its renowned crispness of control. Though the Auster A.O.P.9 was not designed for aerobatics, the merciless reversals of aileron applied by Ranald Porteous showed that it lacks neither liveliness nor strength of construction. Two noteworthy points of the demonstration, performed with full military equipment, were a 100 yd take-off and short landing preceded by a steep, side-slipping approach.

The Prestwick Pioneer, Capt. Roy Smith up, executed its customary bird-like departure and, after a quick circuit, completed its landing run almost in "nought feet."

A simulated balked landing and overshoot with one Leonides inoperative and "everything down" was the highlight of the Pembroke's fly-past. The version flown was a standard C.Mk 1 in R.A.F. colours. Operation of the newly developed D.H. feathering airscrews for the Heron was shown by a metallic-green Series 2, which flew past with both port airscrews stopped. Evolved primarily to meet U.S. requirements, the "feathering" Heron has a higher a.u.w. (13,150 lb, compared with 13,000 lb) than the normal Heron 2, and its climb performance with one engine inoperative is better by some 40ft/min.

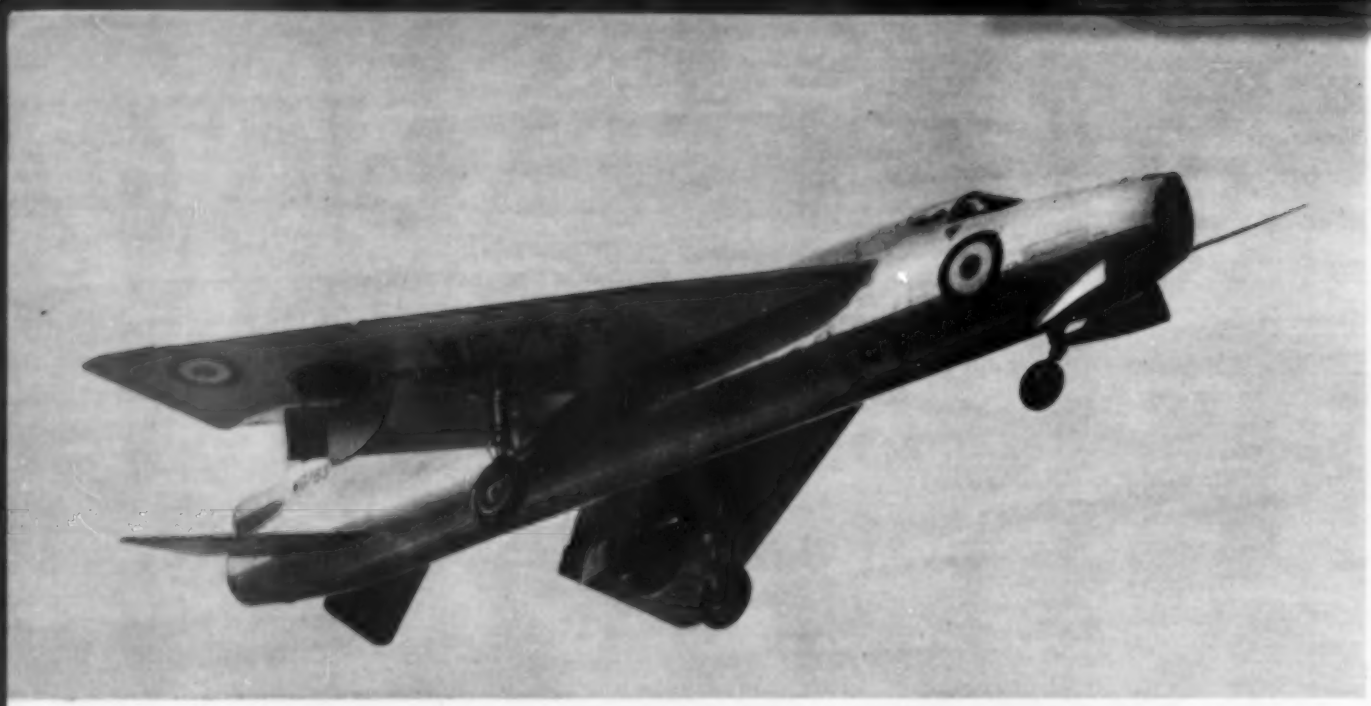
Next, a noisier circus, led by the Canberra B.8 "night interdictor"—a dashing performer in the true Canberra tradition. In his demonstration of the Olympus-Canberra, G. Auty used every ounce of the thrust increase which, during the previous week, had enabled colleague Walter Gibb to add 2,208ft to the altitude record. The climb-away was perhaps steeper and faster than ever before, and the near-vertical, wheels-down overshoot gave new meaning to the phrase "going round again". The Hunter 4's excellent performance, terminated by a sequence of three rolls, was the more remarkable for the collection of appendages slung asymmetrically beneath its shapely wings: two Bristol "supersonic" plastic drop-tanks (port outer and starboard inner), one 1,000 lb bomb (port inner) and 12 rockets (starboard outer). According to reports, it has been supersonic with all these stores.

Bristol's handsome, glittering helicopters—171 and 173—performed in parallel. Impressive features of the larger, twin-rotor machine's repertoire were its steeply inclined turns and a protracted tail-first passage along the length of the enclosure.

For a helicopter which first flew as recently as August 14th and which is, moreover, of novel design, the Fairey Ultra Light was in remarkably fine fettle. Confidently handled by S/L. Gellatly, it showed a fair turn of speed and manœuvrability. In flight, the Blackburn Palouste emitted a kettle-like hiss, to which was added the cricket-like chirp of the little tipjets. More formidable sounds came from the Ultra Light's stablemate, the Jet Gyrodyne, when, at a height of about 1,000ft, F/L. Dennis cut-in the tipjets to translate from autorotative to true helicopter flight; the aural effect was not unlike that produced by a distant, heavily loaded goods train. With the rotor-jets silent once more, the Gyrodyne descended steeply and rapidly for a precisely checked autorotative landing on the runway, whereupon it taxied conventionally, and relatively quietly, back to its dispersal.

Two of the most recent products in the display, the Westland Whirlwind 5 and Widgeon, gave a well-synchronized perform-

(continued on p. 481, after three pages of Show pictures)



THE WEEK AT FARNBOROUGH . . .

(Above) A particularly informative study of the English Electric P.1 (two Armstrong Siddeley Sapphires) on a slow run—and, incidentally, a lesson in the perspective of swept surfaces.

(Left) The Avro Canada CF-100 Mk 4 (Orenda 11s), with a Hughes fire control system in the nose and expendable rocket packs at the wing tips. Note, too, the complete de-icing provisions.

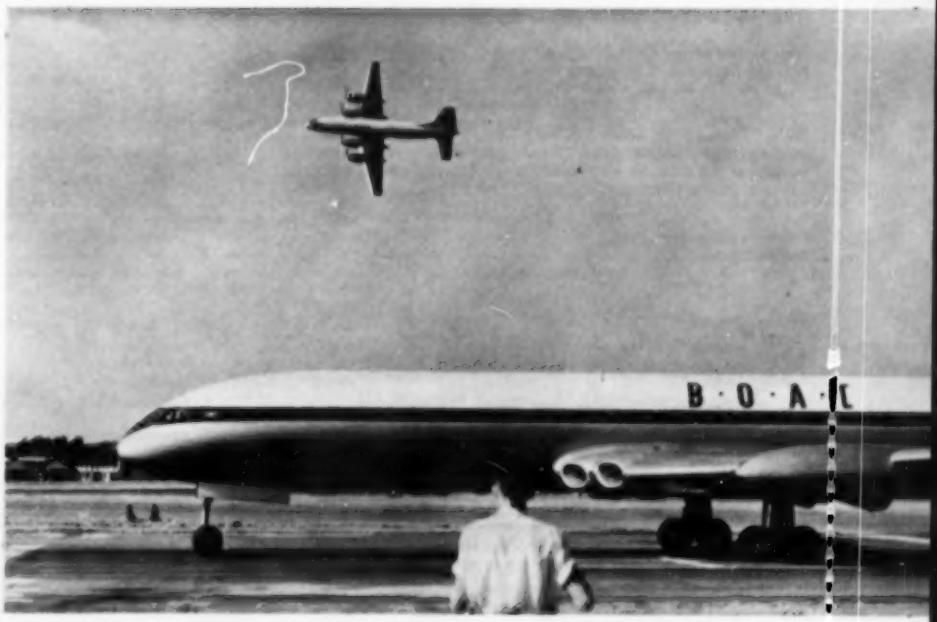
(Below) The clean-cut, handsome Handley Page Herald (four Alvis Leonides Majors), finished in white and silver with the red flash and lettering of Queensland Airlines.

(Above) A smart getaway by the Fairey Gannet T.2 anti-submarine weapon- and engine-handling trainer (Armstrong Siddeley Double Mamba).

(Top right) Bristol's Olympus-powered English Electric Canberra, holder of the world's altitude record at 65,876ft, gets under way for one of its altogether phenomenal demonstrations of climbing power.

(Right) Two of Britain's white hopes in the civil field: the Bristol Britannia (four Proteus) and the Rolls-Royce Avon-powered de Havilland Comet 3.

(Below) The tenth Hunting Percival Jet Provost, designated T.Mk.2, has a more powerful Viper and a wholly new, and much shortened, undercarriage. Note the revised rear end, accommodating the larger tailpipe.



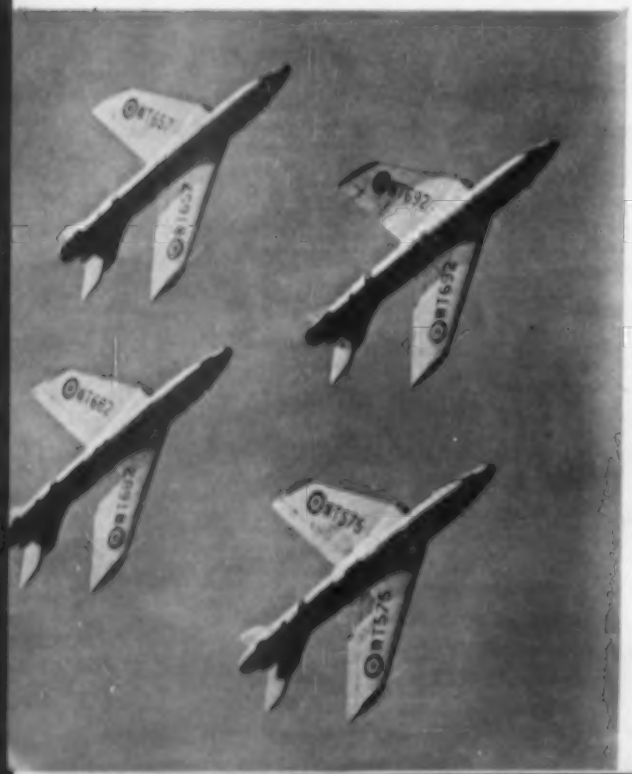
Above. Two of the 12 Vickers-Armstrongs Valiant B.1s of No. 138 Squadron, R.A.F., pass by at a speed (according to an Air Ministry announcement) of 287 m.p.h.

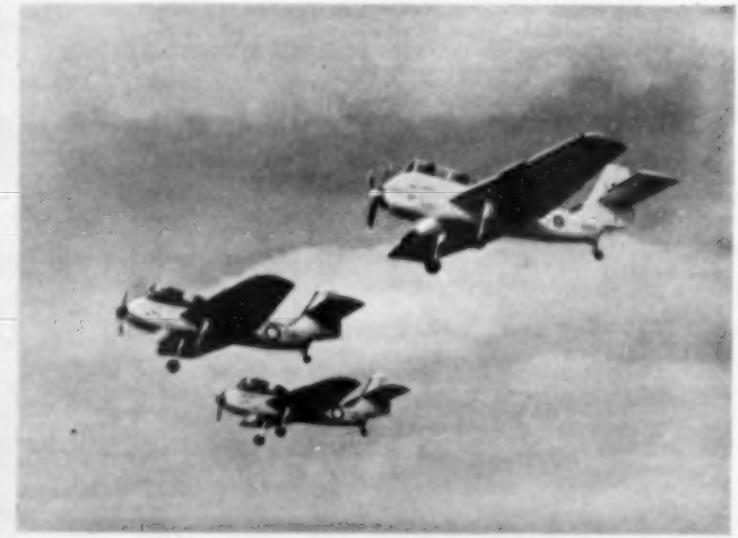
Right. Through the afternoon haze, the sun flecks the leading flight of an R.A.F. Hunter formation—one-quarter of the total fly-past—making a picture of speed and symmetry. They flew at 400 kt.

Below. Pulling high g are the Hunters of No. 54 Squadron aerobatic team. The airmanship and showmanship of this quartet were superb.

Bottom right. Of these three Short Seamews, the nearest is the first prototype, in Coastal Command colouring. Leading is the third production machine, and most distant the second prototype (both in Naval colours).

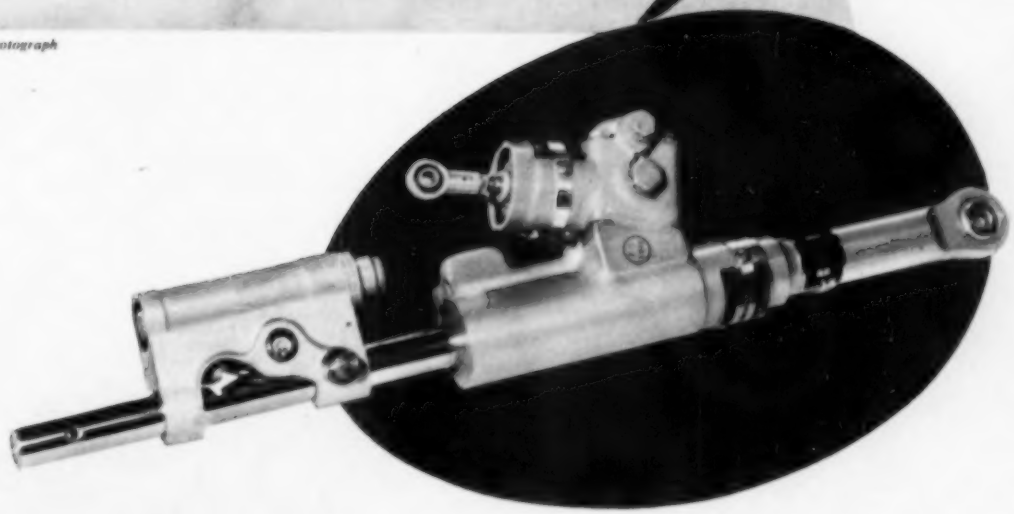
THE WEEK AT FARNBOROUGH . . .





"*FLIGHT*" *Photograph*

flying to fine limits



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DESIGNED SPECIFICALLY FOR SUPERSONIC FLIGHT

INITIAL TYPE TEST — 15,000 lb. STATIC THRUST

DE HAVILLAND ENGINES

THE WEEK AT FARNBOROUGH . . .

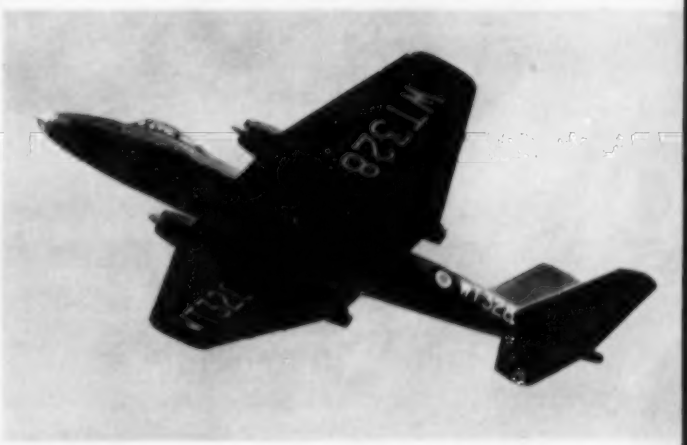
ance. Without a visual yardstick it was difficult to assess the full benefit conferred by the Whirlwind's Leonides Major, though use of the more powerful engine should considerably improve the payload-range capabilities of this well-tried helicopter. The Widgeon, presented by Roy Bradley and looking most attractive in white and blue, gave perhaps the liveliest of all the helicopter demonstrations. It was followed by the sprightly Skeeter 6, in Training Command colours.

Among transports at Farnborough, the brand-new Twin Pioneer and Herald naturally commanded the greatest share of attention. Both prototypes emerged with flying colours from their first public appearance, and no effort of the imagination was required to visualize either at work on the "outback" routes for which they have been designed. Without headwind assistance, Capper lifted the Twin Pioneer off in well below 100 yd and set it down in an equally short space; on Friday, landing into a stiff headwind, it pulled up within its own length. The Herald likewise "leaped into the air"—200 yd being an estimate of its distance-to-unstick, unladen. Showing every confidence in Handley Page's new "workhorse airliner," Hazelden about-turned steeply for a full-throttle, jinking fly-past at a healthy 200 m.p.h. or more.

Viscount, Britannia, Comet . . familiar names in the Farnborough programme, though none the less welcome for that. Rymer's demonstration of a T.C.A. Viscount (the 14th) included a fast passage with two Darts feathered. The Britannia 100, flown by Pegg, provided a reminder that great size and low noise-level are not necessarily incompatible; perhaps the noisiest part of its act was the "thrum" from its reverse-pitch airscrews, employed to full effect at touch-down. Cunningham, in the

Above, the English Electric Canberra P.R.9 with lengthened span and centre section of deepened chord, ascends under the thrust of Avons—placarded as 206s. Below it is the Hunting Percival Provost, in Iraqi markings, and last the English Electric Canberra B.8 night intruder, now with camouflaged upper surfaces. The gun pack is seen.

Below is the Gyron Sperrin, showing the mighty de Havilland turbojet in the lower part nacelle, with the Avon above looking like a mere oil-cooler. Next is the Auster A.O.P.9, a standard production machine, and last, the Scottish Aviation Prestwick Pioneer (a new one, but generally resembling those serving in Malaya).



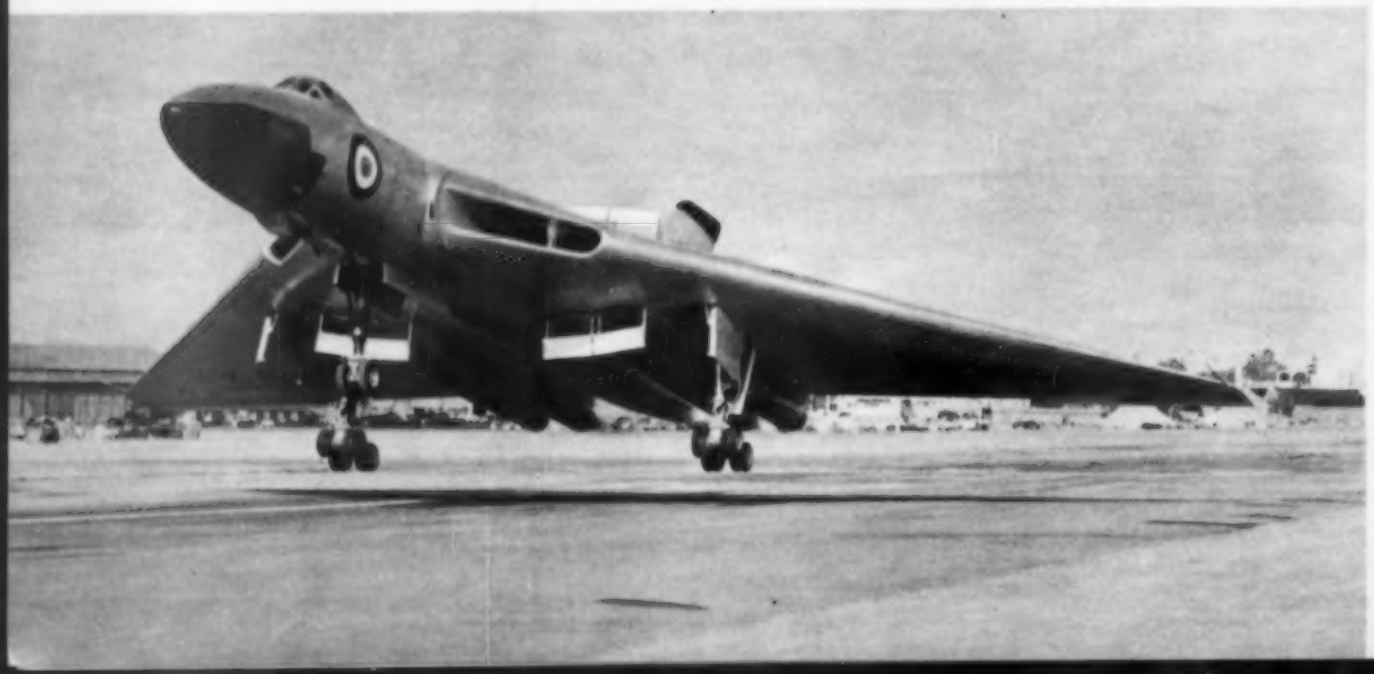
(Above) Study in V-bombers: the Vickers-Armstrongs Valiant B.1 (four Rolls-Royce Avons), with under-wing auxiliary tanks, sweeps low past the Handley Page Victor B.1 (four Armstrong Siddeley Sapphires). Air brakes are extended from the rear fuselage of the Victor, now finished in blue.

(Above) Precipitating vapour over its cockpit canopy is the Hawker Hunter Two-Seater (Rolls-Royce Avon). The housing of the two guns is also in evidence.

THE WEEK AT FARNBOROUGH . . .

(Left) The Saunders-Roe Skeeter 6 (D.H. Gipsy Major 200), now going into production.

(Below) The second pre-production Avro Vulcan B.1 (four Bristol Olympus), with its revised nose, largely composed of a dielectric covering over the radar bomb sight. This bomber has aerobatic capability.

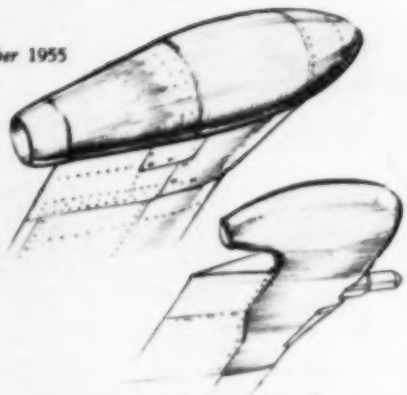


(Above) The Fairey F.D.2 delta-wing research aircraft, powered with a Rolls-Royce reheat Avon, gets airborne with its nose—of distinctly medieval conception—untilted. This picture should be compared with the close-up view of the nose on the left, showing how this entire portion can be lowered to provide the pilot with sufficient view for landing.

(Left) One of two examples of the executive version of the de Havilland Heron 2, with feathering D.H. airscrews for its Gipsy Queen engines. The port outer airscrew is, in fact, feathered in this picture.

(Below) Carrying two 100-gallon plastic tanks is the Hawker Hunter F.6, powered by a Rolls-Royce Avon, having an enlarged tailpipe by reason of its increased thrust.

The Fairey Ultra-Light helicopter, in small-scale production for the Army, seen about to touch down.



On the right is a comparison of the tip-jets on the (top) Fairey Gyrodyne and (bottom) Ultra-Light helicopter.

Model of the Fairey Rotodyne with two Napier Eland engines.

The new Westland Widgeon is roomy and manœuvrable.

THE WEEK AT FARNBOROUGH . . .

beauteous Comet 3, appeared to use far less tarmac for both take-off and landing than on any previous demonstration of the D.H. jet transport.

The end of the circuses was marked by the R.A.F. component of the display. First, six pairs of Valiants from No. 138 Sqn., Wittering, flew past at a relatively low speed; and as each pair passed over the audience they broke, the aircraft climbing away individually at full bore with fuel streaming from their wing-tip vents. They were followed by 64 Hunters in four immaculate wings of 16 in box fours. They came from Nos. 1, 41, 56, 111, 222, 247, 257 and 263 Sqns.

Finally, the R.A.F. produced one of the highlights of the show, the aerobatic team of four Hunters from No. 54 Sqn., Odiham, led by Capt. R. G. Immig, a U.S.A.F. officer on exchange posting. Capt. Immig brought the team in from the Blackbushe direction in line astern and went straight up into a loop, changing into box formation on the way up. They came out 90 deg off their first heading and winged over into *échelon* starboard. Then they flew past in front of the enclosure and rolled to port, changing into box formation. They winged over again, looped in box, and then winged over into line astern. From this formation they once more rolled into box and then soared up into a loop. As they dived down out of this, right in front of the crowd, they produced the spectacular parting shot—a downward bomb-burst, during which each aircraft left a fine trail of red smoke from a cannister under the tail; and the whole team then disappeared as each member made off "on the deck." In showmanship and virtuosity the No. 54 Sqn. team is well up to the American Skyblazers' standard.

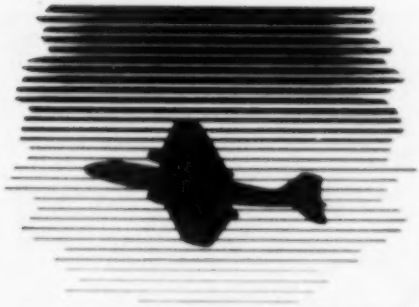
Four Seamews were flown in the display, piloted by a team of Short's pilots. The first three took off in vic and the fourth alone, and then all returned in box four and made a Prince of Wales's feathers break, the two outside aircraft rolling and the leader looping. A turn to starboard brought them all into line astern for some runs followed by a stream landing. On several days they made great play, before take-off, of wing-folding and unfolding in unison.

The big grey Shackleton 3, flown by Johnny Baker, is much heavier than its predecessors, but the elimination of the dorsal turret and increased power from the Griffons have led to a notable increase in speed which was demonstrated to the full during the show. Noise level is much reduced. Tab-assisted ailerons, in four sections on each wing, have improved lateral control. The aircraft flew past each day with three airscrews feathered.

The Jet Provost T.Mk2, another aircraft with a new look, once again showed that its handling qualities are, if possible, better than those of its piston-engined predecessor. Its purposeful appearance in fact belies its performance, and Dick Wheldon showed that with its up-rated Viper it combined the tight-turning circle of the light aircraft with the effortless zooms of

The Westland Whirlwind H.A.R.5 has an Alvis Leonides Major engine giving improved performance.

The Bristol 173 (two Alvis Leonides)—forerunner of advanced military machines.



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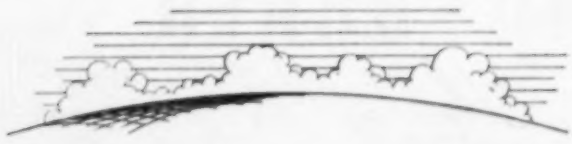

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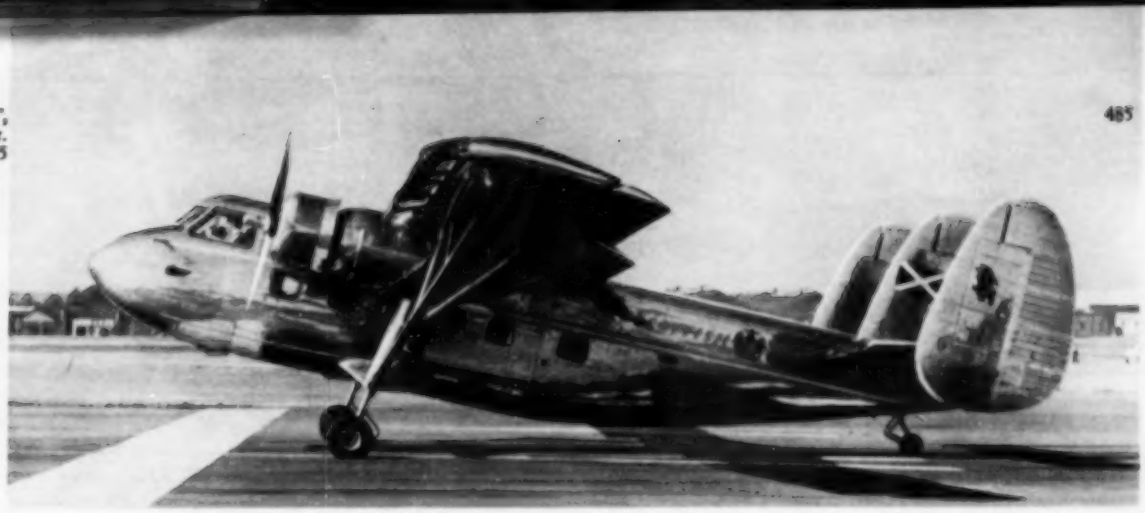
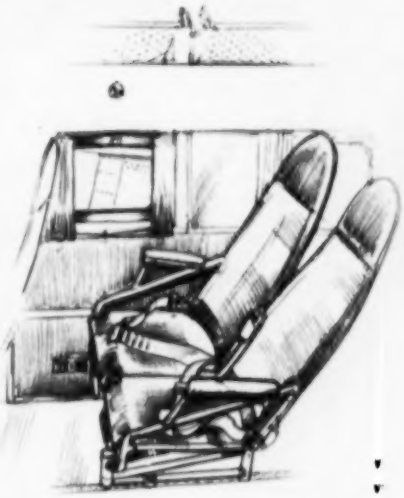


Though lacking the æsthetic appeal of high-speed airliners, the Prestwick Twin Pioneer has a character of its own. Lettering and styling are in the best Scottish Aviation tradition. (Left) The cabin, looking forward; the example on show had 16 seats. Cabin length is 19ft and head-room 5ft 8in. (Right) The Twin Pioneer's Rumbold lightweight seats, each weighing 21 lb. Covering material is a woven string impregnated with fire-resistant plastic and looking like basket-work.



THE WEEK AT FARNBOROUGH . . .

the jet. Performance is better than that of earlier Jet Provosts.

The first of the noisy individual demonstrations was by the Canberra P.R.9 (modified by Napiers from a P.R.7) which, on the power of two Avon Mk 206s, showed that its low-level performance is as good as its high-level capability is reported to be.

Bill Bedford and Frank Bullen between them shared the demonstrations of the two-seat Hunter, which may have tactical as well as training possibilities. The addition of a somewhat bulky nose to a Mk 4 airframe seems to have affected the performance little and it was pleasant to see again a blisteringly fast pass by a duck-egg-green Hunter.

Wilson and Elliot put up fine performances in the first Christchurch-built D.H.110. A roll off the top on take-off was easily accomplished and followed by an excellent eight-point hesitation roll. The new barn-door brake under the nose was used in conjunction with the earlier brakes round the jet-pipes. Sometimes the 110 landed with arrester hook down.

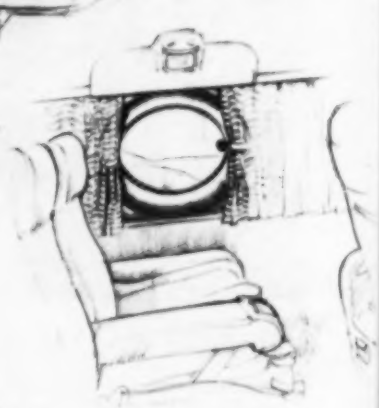
The three V-bombers flew one after the other, with J. W. Allam putting up some quite fast runs in the sky-blue second Victor. As he came past the horizontal tail could be seen to flex in the slightly turbulent air. Now in service with the R.A.F., the Valiant B.1 was flown by Brian Trubshaw, who, despite the huge under-wing tanks, made some of the fastest passes at Farnborough this year. It was "Roly" Falk who practically stole the show on the first three days by completing a splendid upward roll in the Vulcan—and it was a slow roll made upwards at about 30 deg to the horizontal, and not a barrel roll. Each time the commentator stressed that Roly was a cautious and calculating

Hunting Percival Pembroke C.1—a standard R.A.F. light transport.

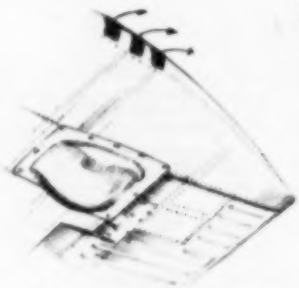
Current production model: T.C.A.'s fourteenth Viscount V.724.

Model of the Aviation Traders Accountant (two Rolls-Royce Darts). A complete rear fuselage was also shown.

The Blackburn Beverley can carry a composite load of 42 passengers in the rear fuselage, three army vehicles in the freight compartment and space on pallets (one of which is seen above the lorry) and wall racks for additional freight and baggage.



Above are seen the rearward facing trooping seats in the tail compartment of the Beverley. A ditching exit is also shown. The sketch on the right shows one of the new (oval) windows of the de Havilland Comet 3. Two windows on each side are used as emergency exits.



On the left is shown the faired aileron mass-balance and de-icing air outlet on the Handley Page Herald prototype.

THE WEEK AT FARNBOROUGH . . .

pilot and each time his remarks were followed by this most impressive aerobatic.

In sharp contrast to the boiling roar of the Vulcan's engines was the gentle rushing noise of the first Gnat, which Tennant took gracefully and quietly into sweeping high-speed loops and very fast passes. And yet out of one high-speed run he banked vertically over the factory buildings and made a tight turn which must rate as the most g-provoking manœuvre of the whole show. His landing, with the assistance of a small tail 'chute, was made in about 500 yd despite the fact that the Orpheus at present has considerable residual thrust when throttled back. The Gnat taxies without dropping its tail 'chute.

Jan Zurakowski's flying of the CF-100 left little to be desired. He threw this heavy machine into an effortless upward bunt and spun blithely down again to a few thousand feet, only to roll his way up to the top again and descend, on several afternoons, in a classic falling leaf.

The Swift, now coming off the production lines as the F.R.5, showed that numerous modifications have not affected the acceleration conferred by the afterburner. On Tuesday it accelerated from "brakes off" to 700 m.p.h. in 1 min 45 sec.

Only one Javelin flew this year but it was claimed to be a standard production F(A.W.) Mk I. Four Gloster test pilots took turns at flying the machine in the display and one of them made an upward bunt similar to Zurakowski's. Though the Javelin's passes were not as fast as some the eerie howl of the Sapphires rendered them just as effective.

The Hunter F.6 showed that the new, more powerful Avon more than overcomes the drag of the two white tanks it carried under the wings. Its passes were as fast as any during the show, and the tanks did not affect its rate of roll.

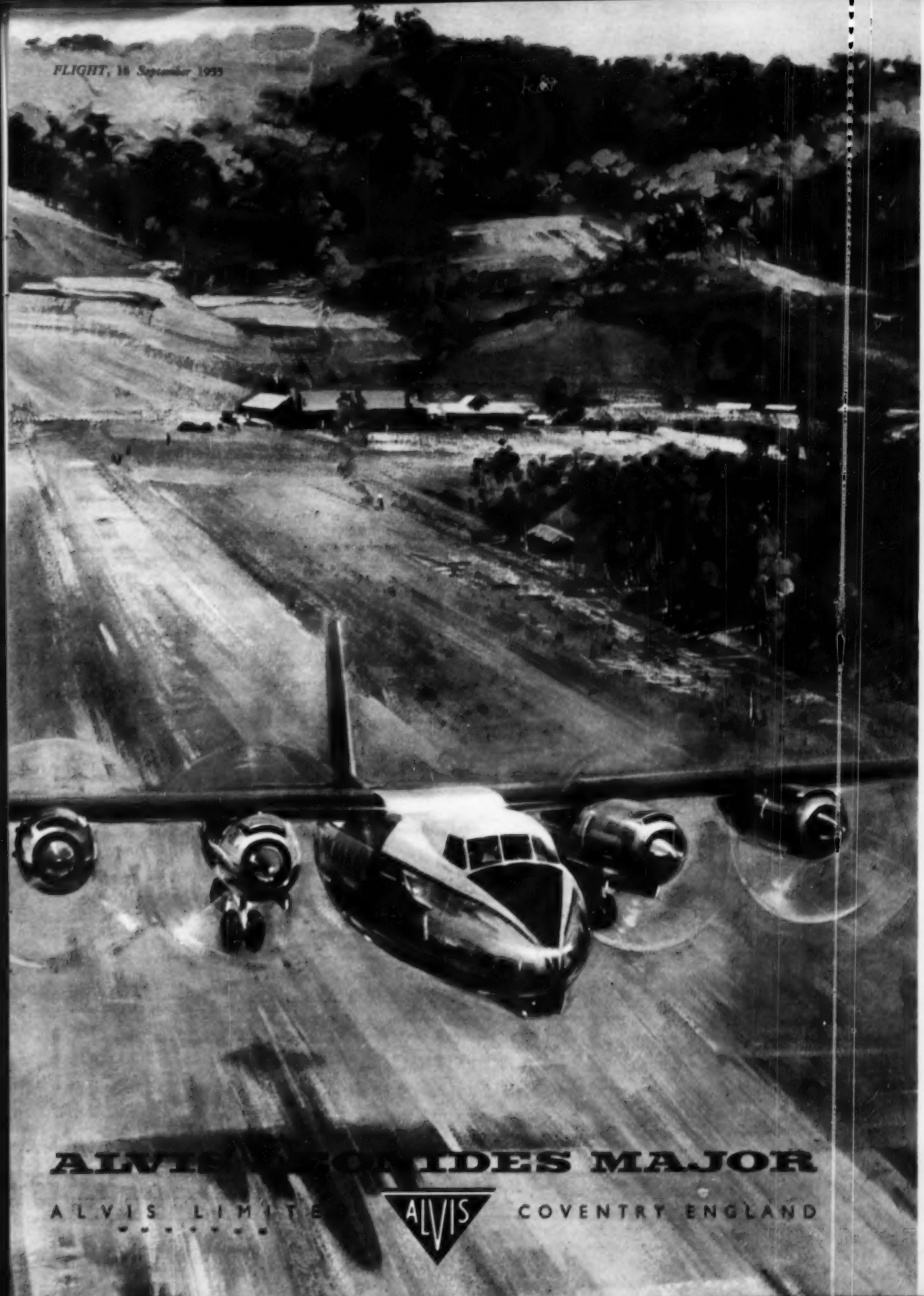
Certainly the most bizarre aircraft in the show was the Fairey Delta 2. Poised on its ungainly undercarriage, it taxied forward to the take-off point with its long needle nose going up and down for all the world as if it was picking up small objects from the tarmac. Take-off technique varied from day to day but each time Peter Twiss lined it up he waited while mechanics performed some mysterious ministration at the nosewheel leg. On some days he lowered the nose briefly for a last look at the runway, raising it again as soon as he got rolling, while on others he took off with the nose up the whole way. At no time did he make use of the afterburner; and his demonstration, carried out rather higher than those of most other aircraft, consisted mainly of straight passes and fairly fast rolls.

Twiss brought the Delta in with the highest approach speed at the show and at a high angle of attack; the nose was fully depressed, and now it seemed to be scanning the ground below for a safe alighting point. Just before touch-down, the cluster of three small braking parachutes was streamed on a very long line from the tail, and immediately the aircraft mainwheels touched down it rocked abruptly forward on to the nosewheel and pressed on purposefully down towards Laffan's Plain.

The P.1 followed the Delta on the Monday, Tuesday and Wednesday. Because of the strict veil of secrecy with which this aircraft has been covered since its first flight in August last year, it has become the great mystery aircraft. The loss of a hood shortly before the show led to a speed restriction on the machine demonstrated. Yet, although Roland Beamont made no very fast runs he showed a degree of manœuvrability at the lower end of the speed range which was most impressive for an aircraft of this size and configuration. On some days he made a slow run with the wheels down and the great flaps fully lowered. The slab tail, meanwhile, could be seen at a pronounced negative incidence. Some notes on the P.1 appear on page 474.

Vickers-Supermarine Swift F.R.5, as now in production for the R.A.F.

Model of the A.W.167 transport project, with five tail-mounted Sapphires.



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At the Farnborough Show Dinner

Sir Thomas White the Guest of Honour

AS briefly noted in our last week's issue, over 1,000 guests —mainly from overseas—were present in London at the Show-eve dinner of the Society of British Aircraft Constructors. It is now possible to report the speeches in rather greater detail. They were made by Mr. J. J. Parkes, the Society's president, who proposed the toast of "The Guests," and by Sir Thomas White, High Commissioner in London for the Commonwealth of Australia.

Mr. Parkes said that there was a tendency for much of the publicity and some of the most immediate interest to be related to prototypes flown in the display. They were, of course, important as indicative of the latest revealed state of British technical development, but since the show was primarily a serious business event and part of Britain's sales effort, it was particularly directed to export markets. There was, therefore, no need to apologize for showing products which had been steadily improved and already giving good service. It was hardly to be expected that any shopkeeper would remove from his window those articles which were enjoying the greatest share of public demand. Since he had spoken last year the aircraft industry had gone a long way on the road from design through development to production and operation.

The problem of aircraft manufacture nowadays was more than ever one of development and not of production. It was usually in the development stages that the major troubles occurred. It was also in the development stages that the customer exploited the most understandable desire for change of design, structure, and equipment in the young aircraft, with the entirely laudable idea of making the final product more efficient for its job. It might almost be said that the customer tried to get tomorrow's developments in today's deliveries. This was understandable and praiseworthy, but it delayed production. Every production engineer knew that the better was always the enemy of the good.

Mr. Parkes went on to say that the influence of the guided missile in various forms was beginning to make itself felt and it would be a bold man who would prophesy an indefinite future for the high-altitude single-seater pursuit or fighter aircraft in the form in which it had been heading. No doubt the all-weather fighter had a longer chance of survival whilst for some considerable time the bomber would be continued. In saying this, the speaker felt sure that ten years was now a short period which just about covered the evolution, production and preliminary usage of a Service aircraft. Coupled with all this were the hopes of mankind for a more peaceful era in the future. If the atmosphere of international tension was now somewhat relieved the aircraft industries of the free world might claim some share of the credit for having brought it about. Men of goodwill could not wish the countries of the world to put a high proportion of their efforts into the manufacture of armaments for longer than was imperative. To be inadequately armed had also been proved a false policy. There was no doubt a balance between the two, related to the degree of confidence and goodwill which prevailed.

The president next turned to the questions of transport aircraft, and after speaking briefly of Viscount, Britannia and Comet progress, said that, though this appeared to be a promising picture, we needed to do more. We must greatly increase our home market for large airliners. We looked to massive extensions of operations by our independent airline companies; the British aircraft industry was watching their progress and development with approval and satisfaction. It was gratifying to see shipping companies with famous names coming in and taking a hand in the promotion of those affairs, and to see the steady improvement in state-owned airways. We could look confidently towards the day when both corporations would operate entirely British fleets.

Mr. Parkes said that, above all this, other and larger outlets at home were needed for our transport aircraft, and greater use of air carriage by the fighting Services. The Army and Navy as well as the Air Force must get into the air in order to achieve world-wide mobility and thereby multiply many times their effectiveness as guardians of the peace of the Commonwealth. If the country was determined to be builders and exporters of large airliners it must make more use of air transport in every way.

After welcoming the guests, among whom he named Mr. Reginald Maudling, the Minister of Supply, the president introduced the guest of honour, Sir Thomas White, referring to him as "an airman minister with a great record."

Sir Thomas White, in his reply to the toast, claimed to recognize in those present "all the symptoms of Farnborough Fever, a recurrent malady which afflicts enthusiasts and converts very important V.I.P.s into very *importunate* persons who find reasons, aviation or otherwise, to appear in England at this time. It says a great deal for their powers of persuasion and imagination that they made it. And let us hope that for aviation's sake the malady recurs annually and not every two years, as is sometimes proposed."

Perhaps the time would come, said Sir Thomas, when instead of meeting in such a chairborne manner as they did that night, the S.B.A.C.'s guests a decade or so hence might assemble in some giant aircraft or in a satellite beyond the terrestrial globe.

On a more serious note, the High Commissioner said it was now realized that, carrying nuclear weapons, aviation could be the most hideous weapon in war's paraphernalia and, so used, could destroy mankind. We were passing through a period of major diplomatic peace, which all hoped might long continue. But amiability was not enough; whilst it meant some abatement of international stresses, changing diplomatic technique and signs of cordiality should not encourage us yet to slow down in the race for superior aviation weapons.

On the civil side great advances were taking place, which an ending of tension could cause further to prosper. Like the S.B.A.C.'s president, however, he felt that we had scarcely touched the beginning of air freighting and that, though still limited in capacity, aerial cargo-carrying could expand considerably, as did the growth of freighting by sea.

In Australia, aviation went side-by-side with development and had assisted them to accelerate settlement and production. Mr. Parkes had expressed the hope that all the equipment for Australian airlines could be supplied from Britain in the not-too-distant future. "Let me say," remarked Sir Thomas, "that your magnificent Viscount is already very much in use there, and many more are on order, the average passenger load-factor is 85 per cent, a splendid operative figure; and the excellent Dart engines in their first 32,000 hours' operation have not had a single engine failure in flight."

De Havillands had been long established there, and had made many of Australia's Service and civil transports; while they and Faireys had recently re-equipped Australia's Fleet Air Arm.

"The first civil helicopters to be ordered for Australia are also British," continued Sir Thomas, "and, I believe, have the engines made by our president's excellent company. Further development in these novel aircraft undoubtedly have fantastic possibilities."

There were also many Handley Page Heralds on order; and Britannias were awaited. Australia was also among the first to order the Canberra, and to make it under licence. It was just too bad that that magnificent aircraft, which held the altitude record and recently did a record there-and-back trip across the Atlantic in a day, was declared to be approaching obsolescence —"Somebody should have told the pilot and navigator."

There was scope, too, in Australia for aircraft of the Twin Pioneer type, for use in the outback, by Flying Doctors, and in many other ways, in regions where aerodrome facilities were limited.

FORTHCOMING EVENTS

Sept. 12-18. Battle of Britain Week.
Sept. 19-23. Institute of Metals: Annual Meeting, Buxton.
Sept. 23. Yorkshire Aeroplane Club: Annual Ball, Harrogate.
Sept. 24. Aircraft Golfing Society: Brown Bros. (Aircraft) Trophy.
Sept. 25. St. Albans Model Aero Club: All Britain Model Aircraft Rally, Radlett Aerodrome.
Sept. 28-30. Institute of Physics: Ninth Annual Conference of the Stress and Analysis Group, Sheffield.
Sept. 29. Northampton Polytechnic: "Fatigue of Metals" (first of series of 12 lectures).
Oct. 1-2. Innsbruck Air Rally: Innsbruck, Austria.
Oct. 7. Helicopter Association: "The Control of Helicopter Rotor Vibration," by P. R. Payne.
Oct. 26. British Institution of Radio Engineers: Annual general meeting and lecture.
Nov. 11. Helicopter Association: "Design of Helicopter Operating Sites," by H. T. Hough, M.I.C.E., M.I.Mun.E., M.T.P.I.
Dec. 16. London Airport inauguration by H.M. the Queen.

R.Ae.S. Branch Fixtures (to October 19th):-
Sept 19, *Halton*, Films. Sept. 21, *Coventry*, Report on the Fifth Anglo-American Conference, by E. D. Keen and Dr. W. F. Hilton. Sept. 23, *Birmingham*, Branch area meeting: "Application of a Digital Computer to Gas Turbine Engineering," by G. C. Best. Sept. 26, *Halton*, Paper by an aircraft apprentice. Oct. 6, *Isle of Wight*, "Recent Developments in Production Processes," by W. E. Goff. Oct. 19, *Coventry*, "Cockpit Hoods," by Dr. Holland.

The Sunday crowd rolls up, with the fine new airport building distant. On the right Stouffer's orchestra gets in the groove.

OFF TO PHILADELPHIA

FOR AMERICA'S NATIONAL SHOW

BY THE ASSOCIATE EDITOR

PART I

Photographs by Harold G. Martin

An F-101 of Research and Development Command at Mach 9.

EXCOMMUNICATION; banishment; deportation. These, I perceived, were my lot as Stratocruiser *Cambria* nosed north-west for Keflavik, purring (and sometimes twitching her tail) like a replete cat. The night was long, and fraught with the awful realization that I had been robbed of my birthright; sold up the River Delaware.

I was doomed to miss the First Day of Farnborough.

The situation had arisen from my contention that America's National Air Show—this year at Philadelphia, from September 3rd-5th—should be recognized as were Le Bourget and Geneva. Why, I had demanded in blind righteousness, should our esteemed and percipient colleagues of *Av. Week* migrate to probe *our* aeroplanes without some counter-migration on our own part? Points of such weight, indeed, that at length I found myself, well behind schedule, in the chilly red dawn of September 1st, at Gander. In my pocket was a fast dog-earing ticket for Philadelphia. In my lap was the job.

In more ways than one the Goodyear blimp did a fine job for its Service.

The jumbled hours droned by, and by the time a WV-2 early-warner had edged into loose formation with us a hundred miles out from New York, I was feeling a shade less desolated. Perhaps I was not exactly a victimized deportee, but just a poor put-upon emigrant, like Paddy Leary (from the spot called Tipperary). Envisaging with satisfaction my associates scrawling through the coming Monday night committing P.1s, Heralds and Widgeons to immortality or perdition, I invoked the philosophy of Mr. Leary himself:—

". . . But before the break of morn,
Faith 'tis they'll be all forlorn,
For I'm off to Philadelphia in the morning."

But I was grimly insistent that Philadelphia had better be good.

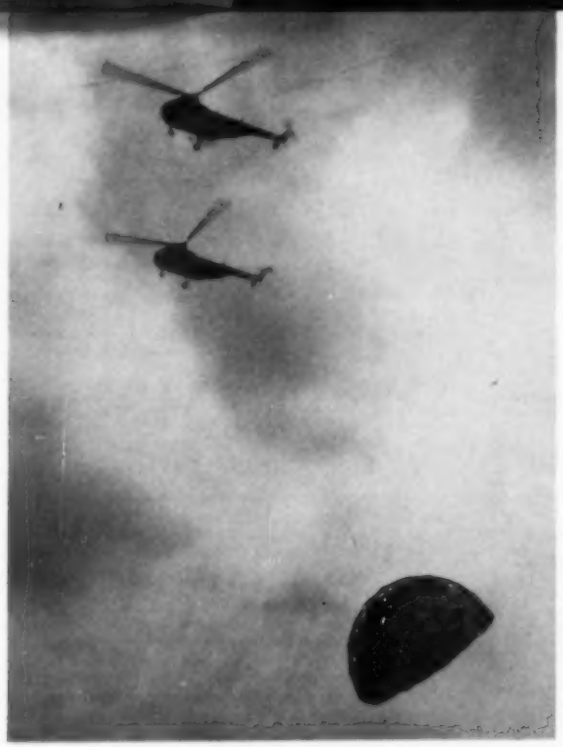
I connected with an Eastern Airlines' Martin 404 *Silver Falcon* with minutes, instead of the promised hours, to spare. For a solid hour I had endured the purgatory of Idlewild Customs in a stewing heat, and my morale had been further shaken by the examining officer, who counseled me not to go on to Philadelphia on any account—especially on account of the place just *died* after eleven.

That city I nevertheless entered, on a muggy afternoon. The oppressiveness, allied to my lassitude following some eighteen hours' flying (*Monarch* comforts notwithstanding), curbed any incipient enthusiasm; but I could hardly do less than seek the whys and wherefores of the imminent meeting, or as it had been described to me, orgy. Having goaded myself into the beflagged downtown headquarters of the organizers, on Chestnut Street, I learned something about the responsible body.

In 1945, I was told, a group of mid-west business men met in Cleveland to consider forming a non-profit-making organization "to promote aviation in all its divisions." From this assembly was born Air Foundation, held to be unique in having "no finely pointed and restrictive objectives." Forthwith the Foundation underwrote the indoor show at Cleveland in 1946, netting $75,000 for the U.S.A.F. Aid Society. It guaranteed the National Air Races of 1946 and the first National Aircraft Show at Cleveland later that year. Thereafter for three successive years it sponsored the Cleveland races and was associated with the 1951 event in Detroit. Jointly with the Dayton Chamber of Commerce it organized a National Aircraft Show to celebrate 50 years of powered flight and performed a similar office in 1954. Now, in collaboration with the Philadelphia Chamber of Commerce, it was sponsoring the 1955 event.

An advertisement in *The Evening Bulletin* apprised me that gate admission was $2 (14s 4d) on the day, or $1½ in advance. A seat in the reserved section cost another dollar, and boxes could be had at $6.25.

At the airfield on Friday I found statically displayed aircraft stretching beyond view. There were scores of them—khaki, green, silver and blue—and in matchless variety. A microcosm of air power. Like great promontories in their midst were the



Two Marine Corps Sikorsky HRS-2s transplant a "geodesic dome."

world's largest aeroplanes, the XC-99, RB-36 and C-124, and, starring among the rank and file, some newsworthy celebrities. I spotted that blue-jowled bruiser the A3D; the long-legged A4D; and the FJ-4, chastely pretty in grey and white. Among the Air Force cast the C-130 was not alone in having turboprops, for at short notice the Allison-powered Piasecki YH-16A, the world's biggest helicopter, was groomed in its builders' compound and manhandled in to join the company. Opposites in all but origin were the bullet-like Bell X-1B, snuggling against its mother B-29, and the chimerical V.T.O.L. Lightplanes blossomed gaily, and with urchin cheekiness a Sopwith Camel squatted by a disdainful Cutlass.

Of the static side there is much to be told next week. For the present—on with the flying show. Not that of Saturday, September 3rd, however, when the sky was a frustrating mess and the Air Force failed to put up even a token performance (though the Army and Navy went ahead); but that of Sunday, the 4th, a day of such relentless heat that the Coke and Schlitz gave out before time, and Bob Simone's orchestra (courtesy of Stouffers Restaurant) took their stand in white sun helmets. The aeroplanes baked and shimmered; the gilded eagles wilted; Old Glory hung limp. Frequently and fervently were the public solicited to give attention, or big hands, to men, machines or merchandise.

On the Saturday there had been a fashion parade by ladies of Gimbels Store, which led me to reflect that although National Defence with cheesecake sauce may not suit all tastes, it does bring into focus something really worth defending. And though I was not privileged to pay homage to Miss National Air Show, I did drink a Coke in the company of a Japanese film star before she was called to the rostrum.

The Academy of Model Aeronautics meet was sponsored by Wanamaker's hobby department; official cars were by Oldsmobile and Dodge; official timing watch by Longines.

The general scene was a carnival of floral shirts and florid faces; white, black and brown faces; gay, sketchy frocks; popcorn, peanuts, hot dogs and cold drinks; burly, gaudy cars in banks of hundreds; bunting and rosettes; cops and troopers with swinging Colts and Smith and Wessons; officious officials on charging Indians; shutterbugs and hot-rod control-line models. Swimming serenely around the sky, now far, now near, was a Navy Goodyear blimp, and off the end of the runway, an aircraft carrier. No mirage this, as it often appeared, but the 40,000-ton bulk of U.S.S. *Ticonderoga*, with F7U-3s, AJ-2s, F2Hs, HUP-3s ranged on her deck. Big merchantmen glided along the Delaware about their business, and work-stained Douglases, Martins and Convairs roared in and out as best they could. The skyline was crawling with helicopters.

The gates were opened to the public at 8 a.m., by which time we—that is, a solitary (crazy) Englishman, and a dozen or so flashing, clicking photographers—had already been an hour on the job.

Towards mid-day three Boeing B-47s, which had left March A.F.B., Cal., between 7.30 and 8 a.m. to race for the General Electric Trophy, were nearing the finishing line on the field. This was the first occasion on which the Trophy had been awarded for a cross-country race; previous events had been 15-25 km speed dashes and a 500 km closed course for fighters. Some minutes apart, the '47s swept smokily over, wheeled for their landings, popping their approach- and drag-chutes, and came screeching to a stop where I was able to view them closely.

The winning machine (actually the third to arrive) was from

At upper right are seen Allison T38 turboprop installations, undercarriage and rear ramp of the Lockheed C-130 Hercules. Below is one of the Boeing B-47s of Strategic Air Command taxying in after the General Electric trans-continental race, won at an average speed of 589.294 m.p.h.

Architectural study: Rear end of the turbine-powered Piasecki YH-16A.

Power egg and rotor head of the Sikorsky XHRS-1.

Wright R-1820 Cyclone installation in the Sikorsky H-34A.

OFF TO PHILADELPHIA . . .

the 443rd "Screaming Parrot" Squadron of the 320th Bombardment Wing, March A.F.B., Cal., and its speed was 589.294 m.p.h. In command was Major Leonard J. Stevens; Major Freeman J. Weedman was pilot, and Capt. Glenn L. Fornes aircraft observer. Good as the speed was, it was well below the wind-assisted B-47 trans-continental record of 641 m.p.h. Placed second was the entry of the 3rd Squadron of the 26th Strategic Reconnaissance Wing, Lockburne A.F.B., Columbus, Ohio; the third machine was from the 369th Squadron of the 306th Bombardment Wing, McDill A.F.B., Tampa, Fla.

I noticed that the '47s were of three models—a "B," modified essentially to "E" standard; a Boeing Wichita-built RB-47E; and a Lockheed Marietta-built B-47E-II. The last, mysterious, designation is possibly of high significance, though I could elicit no information.

At one time the win was in some doubt, for Major Stevens' machine had crossed the line above the decreed level of 1,000ft, having strayed a little off course when the radar went unserviceable. The judges, however, had managed to clock it in and all was well. Some 600 U.S. gallons of fuel remained.

The official opening at 12.30 was proclaimed by a Salute from Stouffers Orchestra. There followed a salvo of maroons and parachute descents by five Pioneer-equipped jumpers, using 28ft orange-and-white Air Force pattern 'chutes. Then the Army took over for a 45-minute demonstration wherein the technical merits of the various aircraft were displayed to the best possible effect, and the competence of their pilots, and the objects of the exercise, were made apparent to the most unpractised eye. A welcome was extended by smoke-laying L-19s and banner-bearing H-13s, while an Army commentator said his piece:—

"We in Army Aviation are the eyes of our brother-in-arms on the ground. We provide rapid mobility for him. We get him to medical aid swiftly when he is wounded. We bring him ammunition, food, and other supplies when he is locked in battle. In this age of rapidly changing battle concepts, the United States Army has integrated the capabilities of the aircraft into its ground army to the extent that Army Aviation is one of the deadliest weapons in the Army arsenal, even though the only firearm carried in Army aircraft is the calibre .45 pistol worn by the pilot."

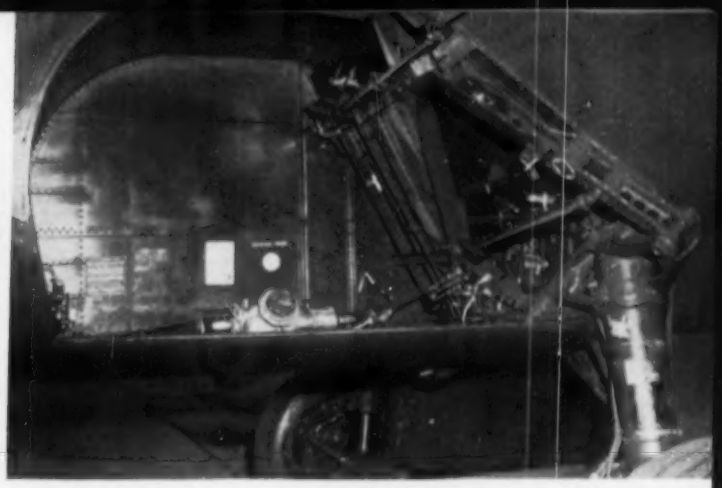
Meanwhile, the G.I.s had erected flag barriers to represent bordering obstacles to a 250 yd strip, and one by one (having previously flown by to show themselves) an L-19, L-20, L-23, H-21, H-25, H-19 and H-13 (the last four being helicopters) came in for their landings. The L-19 approached, with the use of power, at a well controlled rate of descent, cleared the barrier, dropped in and pulled up short. Then came the far heavier L-20, right on the stall, braking to a stop in a hundred yards or so.

These performances were not unexpected, but what astonished me was the performance by the L-23, which is merely a Twin-Bonanza in uniform. Though its approach and landing characteristics fall well below those of the L-19 and L-20, it grazed in over the barrier at some 80 m.p.h. and came to rest within the prescribed distance. A superb piece of flying.

To make things tough for the helicopters, each had to land in autorotation—a manœuvre, it was explained, which calls for high degrees of skill and judgment and a very keen sense of depth perception. The H-21 took the plunge first. "Here it comes," yelled the commentator, "six and one-half tons of helicopter plummeting earthwards at 1,600 feet a minute." So, indeed, it did, resembling at the final flare-out phase, with its banana-like fuselage reared steeply in the air, some prehistoric monster at bay. Then the H-25 came plummeting down, nose sharply dipped, and lived up to its name of Army Mule by finally rearing up at an altogether fantastic angle, little short of the vertical. The H-19 (which on the Saturday had failed to maintain enough speed and had to resort to power) was followed in by the little H-13, dropping at great speed before its flare-out.

Offset drag-chute housing, tail skid and undercarriage of F-100A.

Rear-nacelle sonobuoy housing on the Grumman S2F-1.



Fuselage undercarriage well on the Douglas A3D-1.

Now it was necessary to get the machines out of the little strip. Ordinarily, it was explained, the pilot would use every inch of field available to him, but on this occasion, for variety, each man was allowed to use his own judgment to see how close he could get to the take-off barrier and still clear it. (During training a pilot who takes a barrier with him buys Cokes for all hands.)

Now hear the commentator: "The L-19 is in position and the pilot revs the engine to full power, holding the brakes. He has lowered his flaps to increase the lift of the wings. Now he releases the brakes and starts his take-off roll. He is feeling out that airplane with every nerve, and, as he senses the first indication of lift, he hauls back on the stick and hangs the plane on its prop, trusting that sturdy little Continental engine to pull him up safely over the barrier. Notice that as soon as he passes the barrier he lowers the aircraft's nose in order to pick up every little bit of precious flying speed available. . . ."

The L-20 showed that it could rise in about the same distance as the L-19, and the L-23, though greatly handicapped, was pulled off at 60 m.p.h. to pass over in fine style.

All the helicopters made jump take-offs, screwing their way into the air before gaining forward speed. Again, the H-25 was unequalled.

Bozo the Clown (behind whose disguise I detected an H-13) whirled dervish-like into the arena, and with his rotor wash proceeded to roll a steel barrel with the utmost nonchalance and precision. Then once, twice—six times in succession, he tilted at small rings and impaled every one on his skid gear.

From the circus to the battle line, with an L-19, sore hit by flak and streaming smoke, spinning down dead-stick. The pilot recovers, turns for the 250 yd strip, scrapes over the barrier and lands heavily but safe.

Then back from the wars and on with the dance, with the Army Aviation Square Dance Team—Hattie and Harriet, Harry and Hank—swinging their partners, do-si-doing and promenading in terrific style. From where I stood I could have sworn that rotors often intermeshed in gay abandonment to the fiddler's charm. The names of 1st Lts. William Brooks and Boych B. Buckner, and Chief W/O.s Arthur R. Tucker and Eldred G. Bourne deserve to go on record with those of the Navy's Blue Angels and the Air Force Thunderbirds. Their helicopters are bubble-canopied H-13s.

Again the scene changed. Philadelphia was held by enemy forces. An L-19 was spotting overhead and the last softening-up shells were arriving. Then the barrage lifted, and over the River Delaware (crossed by Washington's boats in 1775) whirred the first wave of the assault force, headed by pathfinders, in H-21s. Within seconds the P.F. force was positioning coloured flags to mark landing points for the main party and setting up radio to communicate with the inbound pilots. Some emplaced protective machine guns. The ground commander signalled to the L-19 that he had a vital message which he did not want transmitted over the radio. Two G.I.s held up their rifles, with a string between them, and the L-19 dropped low, trailing a weighted

Retractable dorsal twin-20-mm turrets on the Convair RB-36H.

The Bell X-1B emplaced in its mother-ship, the Boeing XGB-29.

Bomb bay anti-buffet "rake" on the Douglas A3D-1.

Afterburner, drag-chute stowage and air brakes on Lockheed F-94C.

The world's largest helicopter, the Piasecki YH-16A. Right, a model showing a hypothetical installation of Hughes Falcon guided missiles.

The much-admired Douglas A4D-1 Skyhawk strike aircraft.

Commander Tallman's Camel turns its back on the mighty Cutlass.

OFF TO PHILADELPHIA . . .

hook with which it snatched the message and carried it back to Battalion H.Q. Flame-throwers gushed; smoke signals streamed.

With the beachhead established and the wedge broadening it became necessary to establish wire communication. Again an L-19 came to the rescue, laying two lines at once before jettisoning the reels. The next requirement was for artillery, but before it could arrive the artillery commander had to be brought in by H-13 to survey the area and reconnoitre for gun positions. As his H-13 departed it laid wire communication from the battery position to the fire-direction centre, tracking crab-wise as the wire paid out to prevent entanglement with the tail rotor.

Flying low to avoid detection and ground fire, three H-19s now rushed in with the gun crews, all of whom were out in twenty seconds; three more brought 75 mm howitzers, suspended by slings and released as the helicopters hovered low.

By this time casualties had been sustained and a call went out for a Medical Corps evacuation H-13 which nipped in piloted by "Mr. Helicopter" himself—Capt. William P. Brake, who personally evacuated by air more than 900 Korean casualties. If needed, the patient could receive a blood transfusion en route by means of a special device invented by Capt. Joe Boler in collaboration with the Medical Corps.

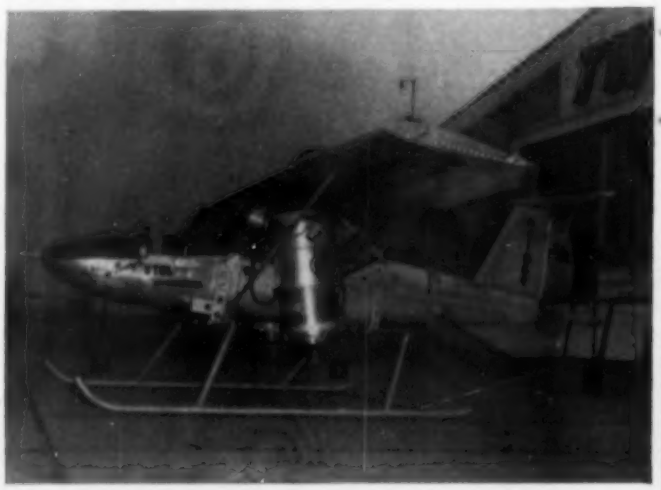
At this point the need arose for re-supply, and an H-25 ferried in a heavy cargo in a net which it lowered by mechanical hoist —a method which is invaluable when terrain is too rough for landing or where brush or trees prevent hovering sufficiently low to release a sling-load. An L-20 added to the build-up with a free-fall drop; then three L-19s parachuted supplies into the same area from low altitude. I gathered that they can usually place their loads within 50ft of the target panel.

Resolved to defend Philadelphia at all costs, the enemy massed a division for an all-out counter attack, and in answer to this danger the commanding officer of the friendly forces signalled for an atomic shell. The L-19 radioed map co-ordinates to the fire-direction centre, and when, over the radio, the pilot heard "On the way," he made a smart exit. With a flash, a thunderous crash, and a mighty mushroom of smoke the shell arrived, and the tide of battle was turned.

(*Technical note:* The simulated atom shell, known to the Army as "Little Peachy," was composed of 2,400 lb of explosives and smoke-producing agents, including 100 lb of white phosphorus,

Below, the Chance Vought Regulus missile on its launching ramp.

Bell's V.T.O.L. machine, with Fairchild and Turboméca power.



The giant Boeing B-52s of Strategic Air Command passing by at some 500 m.p.h.

Presentation of the two Convair F-102A delta-wing all-weather intercepters at Mach 9.

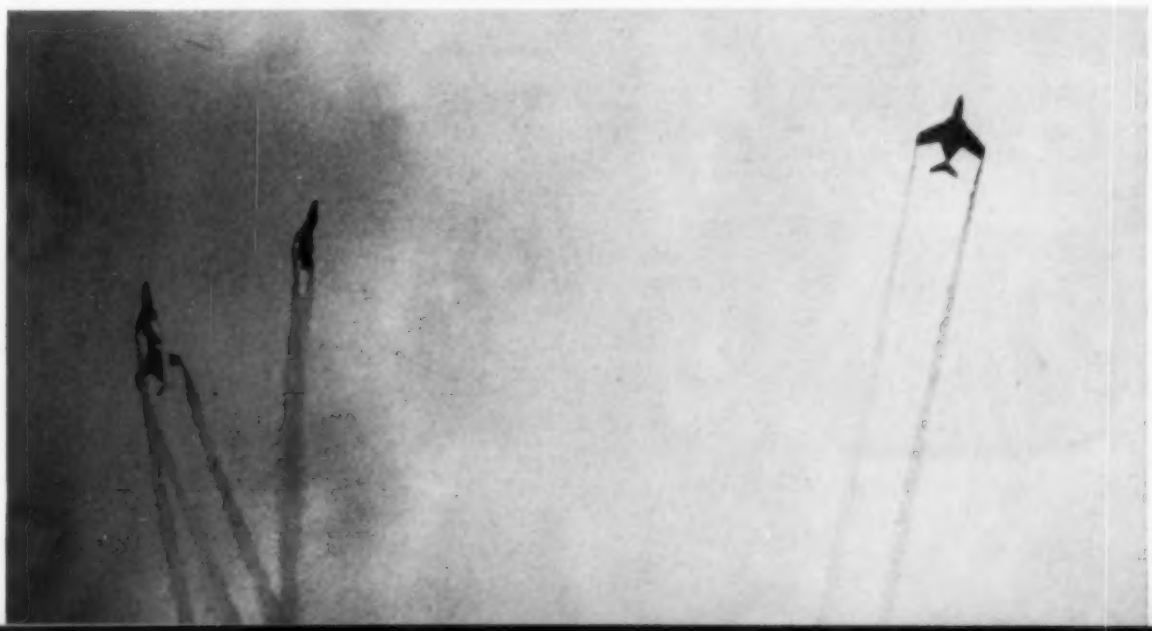
760 lb of petroleum compound, 500 lb of primer cord, 300 lb of TNT, and 5 lb of C3—a high-explosive putty.)

Came the commentator's voice: "We have tried to show you what Army Aviation is, why it exists, and what we do in combat. We have attempted to show you the Army's forward-thinking and technological air-ground development. This demonstration was intended not only as a show, but also as a thank-you salute from the United States Army to those whose life and liberty we are dedicated to preserve."

The flying demonstration—a great credit to all concerned—was presented by pilots from the Army Aviation School, Camp Rucker, Ala., the 82nd Airborne Division, Fort Bragg, N.C., and the Third Infantry Division, Fort Benning, Ga. The H-21s were from the 580th Transportation Company, Fort Bragg, and the 509th Transportation Company, Fort Belvoir, Va.

I shall describe in the next instalment the U.S.A.F., Navy and Marines demonstrations, the statically parked aircraft, and such miscellaneous items as I spotted and considered worthy of attention. I shall deal, too, with the Bendix Trophy Race, won by Colonel Carlos M. Talbott in a F-100C at 610.726 m.p.h.—a somewhat disappointing figure, though the flight was made in unfavourable circumstances.

Break-up of the U.S. Navy's Blue Angels demonstration aerobatic team, mounted on Grumman F9F-8 Cougars.



Plessey ram-air turbine.

TECHNICAL PROGRESS

Some New and Significant Developments Seen in the

WITH a total of 307 companies exhibiting this year under the "big top" of the Farnborough exhibition hall, and other wares on view in the outdoor equipment exhibition and covered arcades, mental indigestion was indeed assured for anyone rash enough to try to see and absorb everything there of technical merit. On these pages we report on a selection of some of the more interesting developments on view, from which the wide range of this year's products is apparent.

AIRSCREWS

de Havilland Propellers. The company's principal new airscrew is a highly efficient turbine airscrew for the 4,000 s.h.p. Rolls-Royce RB.109. It has a diameter of 14ft (later to be increased by six inches), and employs four blades of the solid forged light-alloy type. There seems little doubt that this will be the lightest and most efficient unit available for this engine, and the whole design seems eminently clean, effective and efficient. Flush electric de-icing pads will be fitted and hydraulic pitch-control, feathering, reversing and pitch-locking are provided.

Rotol. It has become abundantly clear that airscrews can utilize solid forged light-alloy blades up to sizes significantly larger than was believed a few years ago. Rotol's new airscrew for the Bristol Proteus (and, by inference, most large turboprops) has a diameter of 16ft and a maximum blade chord of 14¼in, yet has blades of the classic light-alloy type.

A fairly typical hydraulic circuit is employed, although a note should be added regarding the hydraulic lock. This is sensitive to overspeeding and to oil pressure. In the event of oil failure the pitch is locked at the position at the point of failure; and, as a further safeguard against seal leakage, a solid mechanical flight-safety lock is fitted to keep the pitch at a value still suitable for cruising. The mechanical lock has to be removed by the self-contained feathering circuit before fine pitch can be obtained.

De-icing is of the rebated-blade type, applied over the inner 60 per cent of the radius and taking cyclic current at 208 volts, 400 c.p.s. The total weight of the blades, with rebating, comes to 486 lb and that of the whole airscrew and spinner to 873 lb. These values are quite comparable to those of equivalent hollow-steel units. The tremendous advantages of the solid light-alloy unit lie in cost, life, ease of maintenance and, in the first instance, ease of manufacture. At a conservative estimate, the blades for a 16ft hollow-steel airscrew cost eight times as much as equivalent light-alloy blades.

ENGINE AND FUEL ACCESSORIES

de Havilland Engine Co. One of those annoying new developments which can be displayed but not sectioned or described is the peroxide starter developed "for the next generation of large turbojets" (which, without stretching the imagination unduly, might include the Gyron). When brought into contact with a suitable catalyst, concentrated hydrogen peroxide decomposes to form a jet of superheated steam and free oxygen. In the Super Sprite rocket the jet is used to provide thrust; in the new starter it spins a turbine which is geared to the nose of the turbojet. The photograph shows the neat unit under a transparent bullet fairing (p. 496).

Dowty Fuel Systems. Continuous development of the single-circuit type of fuel system, with spill burners, has now resulted in "systems engineered" installations with a number of good features. From the performance aspect, all-speed governing is provided, with mechanical control of top-speed, and with mechanical or electric trim for control of maximum temperature. The characteristics of the spill burner are such that the bulk flow requires no fine filtration, no filter de-icing and no fuel preheating. The servo flow, on the other hand, has a sufficiently small volume (about 30 gal/hr) for this flow to be filtered without trouble.

The two chief exhibits were quarter-longitudinal sections of two turbojets, one with 16 upstream-injection burners and the other with 10 spill burners injecting downstream; the former having a twin-pipe gallery and the latter having the concentric type of gallery with the spill pipe mounted inside the main supply pipe. Both exhibits seemed to represent actual engines which could be seen elsewhere in the Static Exhibition. The former installation had a maximum flow of 2,100 gal/hr and a total weight of 91 lb, including burners and gallery. The latter (a two-spool engine), was designed for a maximum flow of 4,200 gal/hr and it embodied an electric trimming control, incorporating an Ultra electric box to provide very accurate speed control to within ±5 r.p.m. at 50,000ft and over. The total weight of the installation was 125 lb.

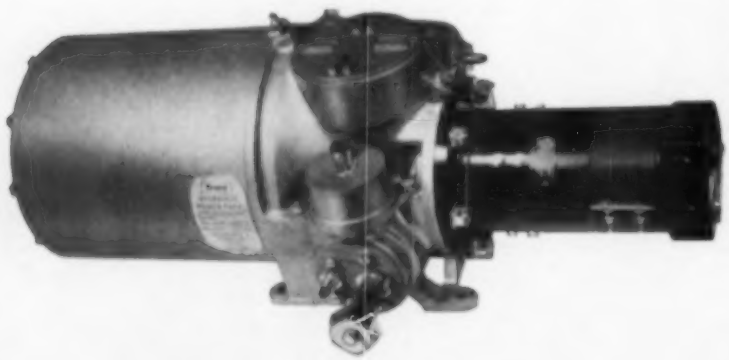
Both installations were engineered to incorporate all units in one large cast body mounted under the axial compressor casing. The geometry of both systems was such that the space envelope of the basic engine was nowhere exceeded, and particular care was taken to provide easy access for maintenance; for example, individual units could be removed without disturbing the remainder of the system. Externally the installations have a very tidy appearance and, owing to the almost complete elimination of external piping, are claimed to be more trouble-free and less vulnerable than previous fuel systems.

Rotax. In the field of aircraft starting devices the principal new development is a monofuel starter using iso-propyl nitrate. From the production point of view the company have fortunately been able to utilise several major components of the original cordite starter; the only completely new equipment being the combustion chamber and turbo-pump.

Although no cartridge is employed, the company have been able greatly to reduce the battery load (compared with the first types of monofuel starter) to less than five amps. Upon depression of the starter button a sequence switch is energized which permits a small quantity of i.p.n. to enter the combustion chamber under pressure of air from a cylindrical bottle. Fuel is then ignited by a spark and the resultant hot gas used to drive the starter turbine. A particular feature of the unit is that only a small turning moment is initially applied as the gas flow builds up, a proportion of the latter being by-passed to drive the turbo-pump which is used to supply the main flow of fuel. Once the turbo-pump is in action the air bottle is shut off.

Although the air bottle is small, its capacity is sufficient for three starts on a large turbojet. A future system may

Plessey hydraulic power pack.



ON SHOW

S.B.A.C. Exhibition Tent

even eliminate the air bottle and draw compressed air from a ground supply.

In a single-engined aircraft the entire system (less fuel and electrical connections) would weigh about 123 lb filled, of which the fuel in the i.p.n. tank accounts for half. This size of installation would be capable of accelerating an engine of 680 to 700 lb/sq ft from rest to 2,000 r.p.m. in from five to seven seconds, the capacity of the system being sufficient for six consecutive starts.

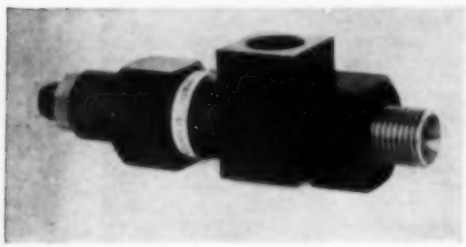
Joseph Lucas (Gas Turbine Equipment). Attention is now being increasingly drawn to the high rate of fuel delivery which could be achieved for a very modest weight by an air-turbine driven centrifugal pump working on compressor-bleed air. The small unit developed for the supply of afterburner fuel (weight 25 lb, delivery 3,000 gal/hr) was again exhibited, and it is likely that equivalent pumps will be developed for the main supply to large turbojets.

Such installations would not be tied to any particular engine, and the control problem at altitude is eased (throttling is better with an air turbine than with a mechanical drive). The governor controls a servo throttle and, although there is some difference of opinion on this subject, it seems to be generally held that the throttle should be in the fuel delivery line and not in the air-supply pipe, since possibly instability may occur with the latter system, owing to the compressible nature of air. For starting, a ground-supply of air could be employed (although, owing to the square-law delivery characteristics of centrifugal pumps the provision of full-flow at starting r.p.m. would imply a pump with a top-speed delivery grossly in excess of requirements).

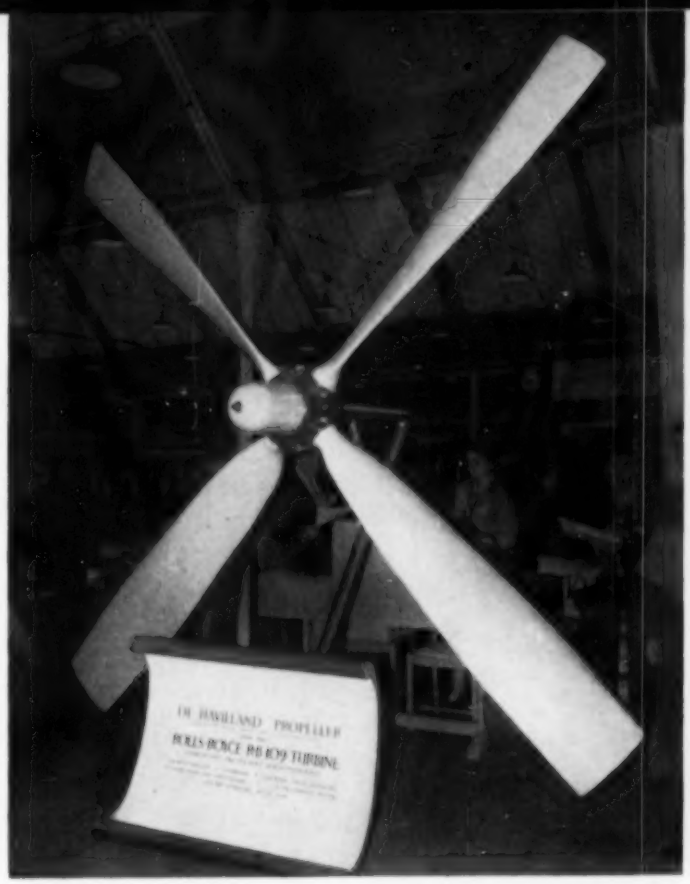
Plessey. To an M.o.S. requirement an aircraft starting system has been developed in which the combustion of iso-propyl nitrate is initiated by a small cordite cartridge. A development of the company's existing monofuel starting system, the new development dispenses with the motor, pumping unit, air blower, electrical igniter and spark plugs. A standard cordite cartridge is fitted in a remote and accessible breech, and is used to pressurize one side of a differential piston. Movement of this piston expels i.p.n. fuel from a fixed-capacity injector to the piston chamber where it meets a cartridge-induced ambient temperature and pressure suitable for ignition. Fuel from the main tank then continues to decompose in the conventional manner. Communication is maintained between the decomposing fuel and the differential piston to pressurize the iso-propyl nitrate; at the end of the start a spring returns the piston to the bottom of its stroke, so recharging the cylinder for the next start.

Piston-chamber characteristics in such turbines depend upon the characteristic length L*, as in rocket motors. Originally, the piston chamber had to be large to relieve the pumping load, but the cordite cartridge can produce about 1,000 lb/sq in, making possible a much smaller combustion chamber. On the debit side is the high temperature of the cordite gas and the fact that two separate stores are required to supply the system.

Ultra Electric. Following closely upon the highly developed B.A.P.3 electronic control equipment for the Proteus has come a neater equipment providing a direct control of turbine speed and indirect control of jetpipe temperature. The main unit comprises an amplifier, Type AN 390, and an altitude-compensating unit, Type ZB 390. The former weighs 8 lb and the latter 1½ lb, and the two together provide a precise speed datum, irrespective of fuel density or ambient conditions, and also permit the use of maximum power at all altitudes without exceeding the limiting turbine entry temperature.



Hymatic 17 one-shot stop valve.



de Havilland airscrew for Rolls-Royce RB.109.

UNDERCARRIAGES

British Messier. More than any other British firm, this company have experience in designing undercarriages for helicopters. Units chosen for display this year were the revised type of short leg for the stub-winged Bristol 173 and the new undercarriage for the wingless Bristol 191. The latter, which is designed to meet Naval rate-of-descent requirements, has a stroke of some 16in. Whereas the 173 leg has suspension springs in compression the 191 has oleo-pneumatic units, conventional except for the fact that they can be inflated to 1½ g when the helicopter is parked on a carrier to prevent roll of the aircraft with the deck.

A castor-lock comes into action when parked, and the brakes are actuated by a coil pipe running up the inside of the leg. Each leg is connected to the airframe by a pair of freely hinged wishbones, but the legs are connected across the aircraft by *ad hoc* beams to which are attached roll dampers on the aircraft centre-line. The latter determine the magnitude of roll. As described on September 2nd, The Palmer Tyre, Ltd. provide brake snubbers which determine the fore-and-aft stiffness.

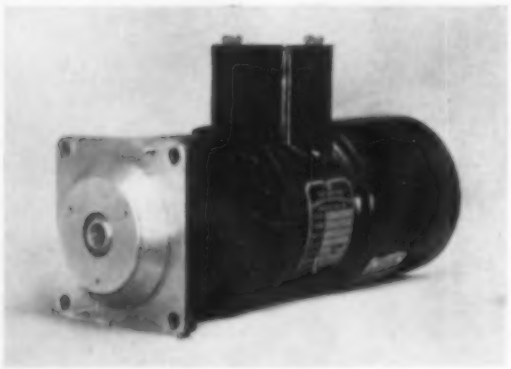
Dowty Equipment. Cleared for public display at this year's Show was the runway brake—a device which appears radical and highly unconventional, yet which is eminently logical and may well supplant wheel brakes entirely in some forms of aircraft.

The reasoning is obvious. In a machine like the Vulcan—for which Dowty supply an eight-tyre bogie main unit—the kinetic energy to be absorbed upon landing is of the order of 10^7 ft-lb. Nearly all of this has to be absorbed by a heavy metal heat sink (the discs of the brakes) which stays with the aircraft at all times. The heat sink of the runway brake is the runway itself.

Under the bogie (that for the Vulcan was on show) is mounted a large shoe made of S.99 steel, to which are secured light-alloy plates on which are mechanically moulded a number of pads of a special

TECHNICAL PROGRESS ON SHOW . . .

de Havilland peroxide starter turbine.



B.T.H. combined motor and gearbox.

synthetic rubber. The shoe is forced down on to the runway by a single jack, with a total stroke of some five inches, operating from the original 2,500 lb/sq in brake hydraulic system. It has been established that instability occurs if all the weight is taken off the main wheels with the nose wheels locked, and the optimum method appears to be to leave 20 per cent of the weight on the sixteen main tyres and to steer the aircraft by the nose unit. A self-contained air-spring is also fitted to absorb runway undulations and prevent the braked run from taking place on a solid column of oil.

Actually, about 93 per cent of the total k.e. is absorbed by the runway, no damage resulting at the surface. The brake pads are expendable, but have a high resistance to wear. The leading pad has a front edge chamfered at 45 deg, and each pad has herring-bone slots to pass rubber dust and water (on wet runways). Incidentally, the front pad sweeps the runway clear and dry, so that full reaction can be obtained by the remainder on all types of surface.

Not only is the retardation likely to be better than that attainable with any other brake system (even when employing an anti-skid system), but considerable weight is saved. On a machine of Vulcan size the saving should be of the order of 700 to 800 lb. An incidental advantage is that the brake shoe can be used to jack up the aircraft when changing wheels.

Other exhibits included sectioned displays of main and nose undercarriage legs for the Hunter, CF-100 (Dowty Canada), and Javelin, and a straightforward Vulcan main leg.

Dunlop. A tubeless tyre designed for the mainwheels of Viscount 802s was shown by Dunlop's Aviation Division, who have been developing this unit over the past year. It is of the same dimensions (36 × 10.75-16½) and uses the same air pressure as the conventional type; its main advantage is a marked saving in weight. The mainwheel tyre of a CF-100 was also on view, in addition to a working model of the company's new tyre-testing facility at Coventry, which should very shortly be in operation.

Electro-Hydraulics. Largest exhibit on the stand of the Electro-Hydraulics company was a main Herald undercarriage leg, forming part of the installation described in our issue of September 2nd. Other units on view were a main leg for the Auster B.8, tail undercarriage for the Twin Pioneer, and main leg for the tricycle Shackleton MR.3. In model form (on both Electro-Hydraulics and Folland stands) was a light-fighter undercarriage mechanism, being developed for a Naval version of the Gnat. This provides for a higher rate of descent and for an alternative arrangement of the wheel door to give arrester-wire clearance. Existing Gnat undercarriage features which are retained include the partial lowering of the undercarriage for use as a dive brake, and the compression of the gear during retraction to save stowage space.

Fairey. Prominent on the Fairey Aviation stand was a port leg of the main undercarriage assembly of the Fairey Delta 2. This is a simple, lightweight, levered-suspension unit, designed and built (with the sole exception of the Dunlop wheels and brakes) by the company. Standard Fairey oleo-pneumatic shock-absorbers are incorporated, and the high-pressure, narrow wheel (as, indeed, the undercarriage design as a whole) was dictated by the extremely thin wing of the F.D.2. Weight of the undercarriage is quoted as under five per cent of structure weight.

Goodyear. A wheel and brake assembly with automatic brake control, as fitted to the Herald, was prominent on this stand. Static load capacity of the wheel was quoted as 8,375 lb, and kinetic-energy capacity of the brake 2.15 × 106 ft-lb. Another wheel design, shown sectioned, was intended for use with a high-energy internal brake for a tubeless aircraft tyre. Static load capacity was given as 24,800 lb.

INSTRUMENTS AND COCKPIT EQUIPMENT

Smith's Instruments. A great deal of work is now being done on instrumentation for crowded cockpits, and also in connection with instrument and auto-pilot integration. The Flight System (described in *Flight*, August 19th) was seen in full for the first time, mounted in a complete blind-flying panel with the related auto-pilot control box beneath it. Another complete panel is that for a high speed, low level fighter. All dials are of 2in diameter, except those of the six blind flying instruments which are 4in across. The horizon is of the new partly free standard, but air-driven; and the air-driven gyro D.I. has a presentation similar to that of the Gyro-Magnetic compass indicators. The A.S.I. has a single pointer indicating Mach number and air speed against a circular slide-rule-type scale. The altimeter is of the three-needle type, capable of indicating up to 60,000 feet. The r.p.m. gauge reads in percentage and the jetpipe temperature has a full circle scale. The three-needle g-meter is also miniaturized and the V.S.I. scale is logarithmic. Flap and air-brake position indicators are of less than one inch diameter with circular dials. **Kelvin and Hughes,** on the same stand, had an A.S.I. reading in knots from 50 to 490 with a white undercarriage warning flag showing at the 170 kt mark.

Mechanism, Ltd., had a range of Mach meters for subsonic, transonic, and supersonic aircraft, one of them reading from 1.0 to 1.4 Mach only. **Ferranti** were showing a series of gyro horizons to the latest Service and civil standards, designated respectively Mark 4 and Type C. There is also the Type 12 gyro unit, used as a gyro reference for auto-pilots. **Sperry Gyroscope Co.** had a stand equipped with a full range of special flight instruments including a complete series of electric and air-driven horizons for fixed- and rotary-winged aircraft. The H.L.4 (helicopter) horizon is fitted in the Skeeter 6.

Martin-Baker Aircraft have, of course, recently carried out the first live ejection at runway level with the standard Mark 3 seat fitted with a release timing mechanism modified to operate after one second instead of just over two. Also on the stand was an example of the latest Mark 4 lightweight seat, two of which are installed in the Hunter 2-seater. The parachute harness is now designed to be put on before the pilot enters the aircraft. When he does climb in, he attaches dinghy pack leads in the usual manner, and threads his shoulder straps through loops in the main parachute lift webs which are permanently attached to the parachute pack on the seat; he then joins shoulder straps and shoulder seat harness together at the single harness junction box. The leg lashings remain permanently on the seat and are attached to the pilot's garters by spring clips. The company will soon make a live ejection with the Mark 4 seat from 44,000ft.

Ground to air operation by VHF airfield communication equipment

Shown above is the type AD 801 transmitter. It is compact and sturdy and, when fitted with shock absorbers, suitable for mounting in a vehicle. On the right is the type AD 818 receiver designed for aerodrome use in association with the AD 801 transmitter.

Marconi Equipment

Type AD 801/818 provides . . .

Optimum intelligibility and range.

Simplicity of operation.

Complete reliability in all climatic conditions.

Flexibility in choice of initial installation and facility for easy addition of channels to meet increased traffic.

Remote control from up to five positions.

Simultaneous broadcast on up to ten channels for multi-channel operation.

More than forty Airlines and twenty Air Forces fit Marconi air radio equipment. Marconi airport installations are in use throughout the world.

Lifeline of communication

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Partners in Progress with The **'ENGLISH ELECTRIC'** *Company Ltd.*

LA 8

B.O.A.C. *B.O.A.C.*

order *order*

2nd *2nd*

Britannia *Britannia*

Redifon *Redifon*

FLIGHT SIMULATOR

REVOLUTIONARY PRINCIPLE OF AIRCREW
TRAINING FULLY UPHELD AFTER YEARS OF EXHAUSTIVE TEST

The hard operational logic of the BOAC Executive has been brought to bear on their experience with Redifon flight simulators which now totals over seven thousand training hours. As the result of the high standard of performance and the low maintenance costs, a second order has been placed for another Britannia flight simulator.

This is further evidence that Redifon simulators provide better facilities for familiarisation than any aircraft in actual flight—and at approximately one-tenth of the cost.

The total number of flight simulators designed and delivered by Redifon now exceeds that of any other concern in Europe or the Commonwealth.

Flight Simulator Division

REDIFON LIMITED, CRAWLEY, SUSSEX. *A Manufacturing Company in the Rediffusion Group*

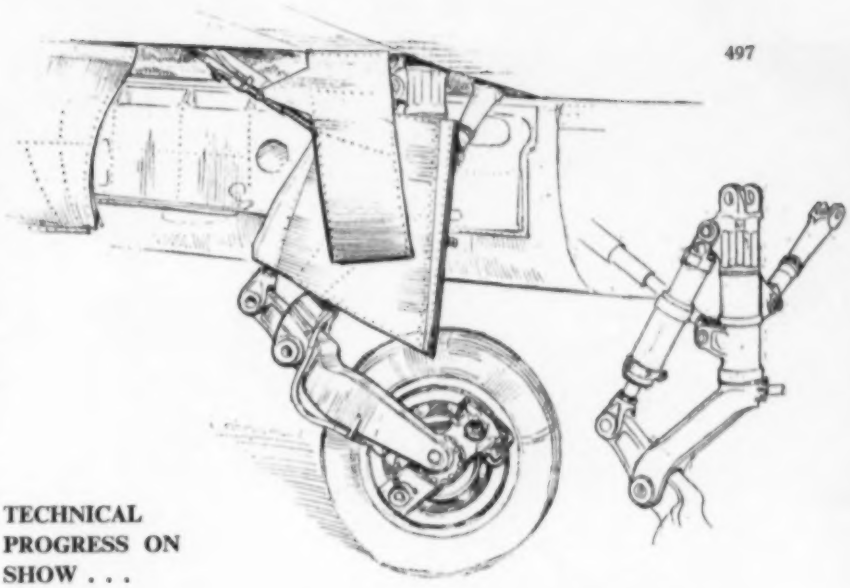
The lightweight seat originally adapted by Folland Aircraft, Ltd., from a Saab design now bears very little relation to its Swedish prototype, and has this year a completely re-designed harness. Parachute and seat fastenings are combined in just four straps and a single junction box; and stirrups have been added. The mechanical leg-restraint gear is not yet fitted. Firing is by pulling a conventional overhead handle to extend a conventional face-blind, or by pulling a handle between the legs. By setting a small lever on the left-hand side of the seat pan the shoulder harness can be locked fully back for take-off and landing, or unlocked to allow ten inches of free forward movement. In this condition any sudden application of g will lock the harness against a ratchet. Seat height can be adjusted by another lever on the right-hand side of the seat pan.

Static firing trials to establish the correct composition of the cartridge are now complete and live ejection will shortly be carried out from a Meteor.

G.Q. make the very neat combined four-point harness of the Folland seat, and they have made provision in the parachute pack for a stabilizing drogue. Seat and pilot separate automatically one second after ejection, and in the case of a long free drop, such a drogue is necessary to prevent violent and perhaps damaging oscillations. On G.Q.'s own stand there was an earlier version of the Folland ejection seat, but main interest was centred round a group of lightweight flying overalls which had integral parachute harness, Mae West, SARAH, a zipped pocket over the right knee, said to be for a code book, and a small white plastic writing slate. The parachute harnesses were for either back-type pilot's parachute or for the chest-type pack. The back-type parachute had an **Irving Air Chute** barometric release capsule sewn on to the suit. This is a new trend in equipment which is still in the prototype stage.

P. Frankenstein and Sons showed a similar type of integrated flying suit, this time fitted with pressure breathing jerkin and the lower half of a partial pressure suit and g suit. This is one of several companies engaged in making the new Mae West, as the Navy's air-sea rescue constant-wear porous immersion suit. A new pattern of aircrew lightweight flying overall had a zip front and zipped code-book pocket as well as white writing slate on the right knee. Also shown was the tropical version made of a different cloth. Both suits had scarves of a material resembling Turkish towelling.

R.F.D. are, of course, well-known for their safety equipment, but this year they showed also their new target drogue trailing gear. It is in the form of a container which can be fitted to the standard bomb-pylon of any fighter. The drogue can be streamed at 130 kt on the end of a 700ft pylon tow cable, and thereafter towed at 300 kt and brought back to the pylon for dropping in the normal way. The container is reloaded by inserting a new roller drogue in the main tube and fitting a new tray of pre-packed cable into a compartment above it (picture p. 498).



Fairey Delta 2 main undercarriage.

TECHNICAL PROGRESS ON SHOW . . .

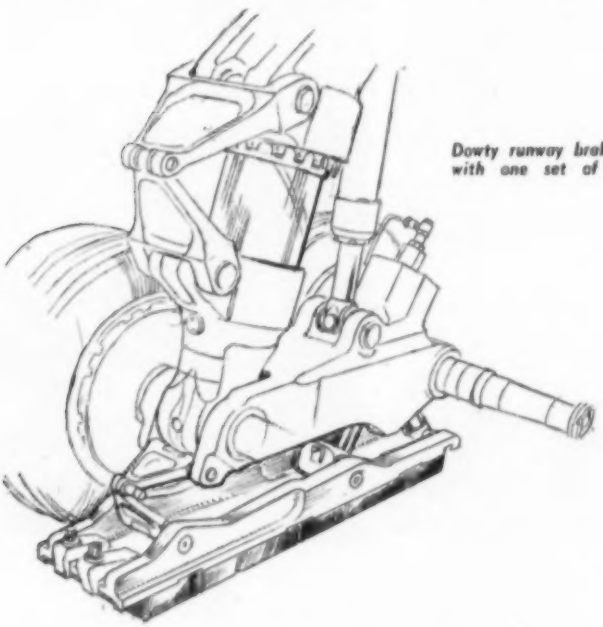
POWERED CONTROLS

THERE was much that was new in powered control, including some variations on standard themes for specific aircraft. Principal innovation, however, lay in the field of control and auto-pilot integration and electrical instead of mechanical transmission from control column to servo. **Boulton Paul Aircraft** showed an experimental piston jack of 25,000 lb thrust with two swash-plate hydraulic compressors. It was much smaller than previous units of this type. A 15,000 lb thrust, single-compressor unit was in the mock-up stage. The company makes the controls for the Vulcan, Valiant, Princess and P.111 A. Principal exhibit was an electrical control transmission between stick and servo, which allows the use of a miniature stick to which many different kinds of feel can easily be applied. By adjusting the circuitry, surface response and forces can be varied through a wide range and auto-stabilizer and auto-pilot signals fed into the circuit. Response could be made adjustable, for example, by the fitting of a rheostat in the cockpit.

H. M. Hobson also showed an all-electric transmission, this time with three separate parallel circuits. Thus if one should fail, the incorrect signals would be overpowered by the other two. Their main exhibit was an integrated flying control system they have developed in conjunction with **Elliott Brothers, Ltd.** Round a conventional mechanical transmission between stick and servo, an electrical system incorporates auto-pilot and auto-stabilizer in the linkage. The pilot can fly the aircraft through an auto-pilot and the movements of the control surfaces will be retransmitted to the cockpit to tell him how the auto-pilot is working. Mechanical transmission only takes effect when the electrical side is disengaged and the stick is allowed to take up slack in a lost motion linkage. The stick is principally part of the electrical system. Having been designed as an integrated system the Elliott-Hobson control system saves weight and size and gives better reliability and safety.

Sperry also exhibited a system of this type.

As in the Elliott-Hobson system, all the three main control originators in a high speed aircraft, the stick, auto-pilot and auto-stabilizer, have been integrated so that their requirements are fed to a central computor and fed direct to the powered control servo. For emergency operation some form of cut-out is provided whereby the stick will once again control the servo



Dowty runway brake (on Vulcan leg, with one set of wheels removed).

R.F.D. under-wing target drogue container.

directly, as is now the general case.

H. M. Hobson, Ltd., also showed the rudder actuator for the Victor, a self-contained, twin-compressor screw-jack unit to which has been added the actuator of a **Louis Newmark, Ltd.**, auto-stabilizer. The actuator transmits its control movements to a differential link at the pilot's input linkage. The unit is designated Type 149 Mk 2. The Type 189, also shown, is the new lightweight Gnat flaperon actuator—a very compact single unit which can, in emergencies, be bypassed by a direct manual linkage. The Type 163 is a screw-jack unit driven by power from a duplicated hydraulic supply, and fitted with a collapsible link which protects it from runaway if a valve seizes. It is fitted to an unspecified all-weather fighter.

The emergence of the electrical control transmission marks the beginning of a true "weapons system" approach by electronics, autopilot and powered control unit manufacturers and aircraft designers.

MATERIALS AND FABRICATED COMPONENTS

Accles and Pollock. Titanium, zirconium and tantalum tubes, a machined tube used in construction of the Beverley undercarriage, stainless steel hydraulic piping, flexible joints, and an 8-ft stainless steel pitot tube were among the exhibits on the Accles and Pollock stand.

Aero Research. Included in the demonstrations on the Aero Research stand was a creep test (at 1,500 lb/sq in, 150 deg C) on 20 s.w.g., D.T.D. 546 alloy lap-jointed with Hidux, the company's new high-temperature adhesive. Other tests concerned Reduxed joints, and their resistance to creep and to cyclic temperature fluctuations from +80 deg C to −55 deg C.

The good qualities of honeycomb-cored structures when compared with conventional stringer-skin assemblies were emphasized in two demonstrations, relating to torsional stiffness and skin stability respectively. Two other interesting components were the honeycomb-cored door of the Fairey Rotodyne (six sq ft, weighing under four lb); and a leading-edge section, with honeycomb between 30 s.w.g. and .003in skins, intended for a ribless tailplane.

Avro. Two test displays in the Avro section of the Hawker Siddeley stand were concerned with illustrating (a) that a metal foil honeycomb panel was approximately ten times stiffer in bending than a normal skin-stringer assembly having the same weight, and (b) the high compressive strength of the honeycomb sandwich construction. In the latter exhibit, the end load in the two skins of the honeycomb beam was 1,266 lb/sq in.

Boulton Paul. An exhibit which attracted much attention was that illustrating a method of thin, straight-taper wing construction recently developed by the company under an M.o.S. research project in connection with a Mach 2 fighter. Basically, the method involves the extrusion in a curved section of the spanwise wing elements, which are subsequently straightened and machined. Six of these light-alloy elements, when riveted together, form top or bottom half of the semi-span wing, holes being drilled through the central thick section of each element for attachment to the opposite half.

Top and bottom halves are joined, by means of special bolts and locking plugs, the ends being machined flush to the skin contour. The surface finish on the examples shown on the stand (one spanwise element and a chordwise cross-section) was extremely good. The completed multi-spar wing has high solidity, and the skin thickness is such that the stabilization normally afforded by rib members is not required. It may be recalled that the Boulton Paul company exhibited last year a skew-pivot control-surface hinge which would appear suitable for this method of construction. Thickness/chord ratio of the wing exhibited is down to three per cent.

Essex Aero. In addition to a large and intriguing "welded fin system" in magnesium belonging to an anonymous guided missile, the development of built-up frameworks incorporating Con-San sandwich panels was exhibited by Essex Aero, Ltd. On test under bending and torsion loads was a ½in Con-san panel, and a welded magnesium windscreen and window frames for the Beverley were also on view.

Firth-Vickers. Centre-die and centrifugal castings in corrosion-resisting and heat-resisting steels were shown, together with a selection of precision castings in stainless and Staybrite steels.

Fibreglass. Examples of high-pressure (about 3,000 lb/sq in) air bottles, made of Fibreglass single-end roving impregnated with epoxide resin and used by Dunlop, Walter Kidde and Rotax, were on view, together with canopy, nose and wingtip fairings for the Slingsby Skylark II sailplane.

I.C.I. (Metals). Two huge titanium ingots of 700 lb and 250 lb respectively, were perhaps the most striking exhibit on the stand of the Metals Division of Imperial Chemical Industries, Ltd. Among the other examples of titanium and titanium alloys were wire, sheet, strip, forging stock, rod, section and tube.

I.C.I. (Plastics). An exhibition of no fewer than 66 different applications of Fluon thermoplastic material was to be found on the stand of I.C.I. Plastics Division. The combination of properties found in Fluon—polytetrafluoroethylene—makes it particularly suitable for the insulation of high-frequency equipment operating at high temperatures.

Jessop. A 7½-cwt bloom of titanium alloy ("prior to manipulation by Jessops," the placard proclaimed) was a striking feature of the William Jessop stand. Also shown were forged rings in titanium alloy, for gas-turbine components; a range of bar materials and wire in the same material; and a scale-balance comparison of the density of Hylite titanium alloy and of Jessop H.46. Various turbine discs in H.46 and G.18B were also exhibited.

Kent Alloys. Centre-piece of the Kent Alloys stand was a large black casting in magnesium elektron zirconium (RZ-5, D.T.D.748) which, it transpired, was one half of a drum hose winding unit intended for a flight-refuelling installation in the Valiant. Also shown, in addition to other smaller castings, was an aluminium-alloy (L.53) ram-housing casting for a Rotax undercarriage actuating unit.

Marston Excelsior. Among recent developments in reinforced plastics laminates, the Marston Excelsior company reports progress in rain-erosion resistant finishes, high-temperature and fire-resistant resins, silicone treatments for glasscloth, and glass fibre honeycomb cores.

Northern Aluminium. Among the Noral forgings and castings on the Northern Aluminuim stand was an example of a stepped hollow extrusion. Developed in conjunction with Bristols, this was a portion of a hollow stepped section for a helicopter rotor-blade spar. By extruding the light hollow spar and the more massive root section in one operation, an integral root is possible and much machining is eliminated.

Redwing. A radar paraboloid, utilizing magnesium - zirconium pressings formed by the Redwing hot-forming process, and fuselage frames for the Vickers Supermarine 544 were the main new items

M.L. pressurized helmet.

exhibited this year. A demonstration rig of the Redwing-Nunn fluid servo was also on view; the same principle is employed in the company's automatic ejection-seat pilot-release gear.

Joseph Sankey. A selection of components cast by the American "Mercast" frozen-mercury process of precision investment casting, which in this country is operated by Sankey-Telcon, Ltd., was exhibited. The main fields of application for this process are stated to be in aero engines, radar wave-guides and guided weapons. Also shown were flame tube, centre section and exhaust cone for the Armstrong Siddeley Viper; and combustion chambers, discharge nozzle and centre casings for the de Havilland Ghost.

Smith's Stampings. Exhibits included three drop-forged compressor wheels in S.62; a drop-forged guide-vane and spacer, also in S.62; and a landing gear cylinder in 4S.11.

Sterling Metals. An extremely wide range of castings in elektron, ZT-1, Z5Z, and RZ-5 was shown, including an RZ-5 windscreen frame for the Fairey Gyrodyne. Photographically, nosewheel and main legs of the Vulcan and Shackleton were included.

Turner Bros. Main development over the last 12 months by Turner Bros. Asbestos Co., Ltd., has been the provision of the vinyl trichlorosilane finishing process on Duraglas glass textiles. A number of Durestos and Duraglas products were shown.

Henry Wiggin. An application of Nimoply 75 (a thin interleaf of copper rolled between sheets of Nimonic 75 nickel-chromium alloy) was shown on the Henry Wiggin stand, in the combustion chamber of a Lucas combustion heater. The purpose of the composite sheet is to combine the high thermal conductivity of copper with the resistance to heat, oxidation and thermal shock possessed by Nimonic 75. Also exhibited was an example of a Thermoflex high-temperature blanket for jetpipe insulation.

MISCELLANEOUS

Armstrong Whitworth. Part of the Hawker Siddeley Group's display comprised a 1/15 scale model of the Mach 3 wind tunnel recently brought into operation at Armstrong Whitworth's guided-weapon plant at Whitley, near Coventry; and also the model—presumably of one of the company's missile designs—which was on view in the tunnel itself at the time of its official opening by Lord Brabazon.

British Messier. Almost equal in size to the Bristol 191 undercarriage leg (p. 495) is the nose-flap actuating unit—which, although not officially described as such, is clearly for the Victor. Large nose flaps require so much instantaneous horsepower that a separate accumulator is necessary. It was, therefore, logical to make up a self-contained unit incorporating a large jack, accumulator and control gear, which can fit into the leading edge of the fixed part of the wing. Operating pressure is 4,000 lb/sq in, and a pressure switch is energized when the flaps are lowered to prevent the latter from being raised until accumulator pressure has built up to its full value. The latter takes only a few seconds.

Another new product is the Type 4839 hydraulic pump, a three-cylinder swash-plate unit embodying the unusual feature of a centrifugal booster stage. A particular characteristic of this pump is its high operating speed of up to 10,000 r.p.m., which permits direct coupling to an air-turbine, electric motor or other source of high-speed shaft-power. At full speed the delivery is 15 cu in/sec at 4,000 lb/sq in, and the weight of some 5½ lb results in the excellent power/weight ratio of about 2 hydraulic h.p. per pound of weight. The elimination of a gearbox saves about 20 lb on a typical four-engined medium bomber.

Martin-Baker automatic ejector seat Mk 4.

John Curran. Responsible for a major part in the development of the mirror deck-landing aid for the Royal Navy (to M.o.S. requirements), John Curran, Ltd., showed a model of a ground-based, mobile version of the aid. This simplified installation (no stabilization is necessary) is used for training Naval pilots in mirror-sight techniques before they go on to use the actual equipment on board aircraft carriers.

Graseby. Exhibiting at the S.B.A.C. show for the first time, Graseby Instruments, Ltd., showed a wide range of guided-weapon components, associated in particular with control and telemetry functions; and also test equipment. Arousing particular interest were the Type GW3 centrifuge (described in *Flight* of August 19th); a rate gyro calibration table; miniature rate gyros and accelerometers, and pressure transducers.

Graviner. An interesting new exhibit by Graviner this year was the company's explosion suppression system, developed over the past five years from an original R.A.E. technique. The installation comprises a sensing device in the form of a photo-electric cell, a fast-acting dispersal unit containing a suppressant agent, and a power pack. In operation, the photo-cell senses the flame front of any incipient explosion; the circuit closes and an electrically fired detonator within the suppressor unit ruptures the container; and this causes instantaneous dispersal of suppressant agent in mist form. The mist quenches the burning gases, an inert atmosphere is formed, and further combustion is prevented.

Other Graviner developments on view included miniaturized Firewire relay boxes, Firewire point-type detectors, and an "omni-attitude" methyl bromide extinguisher bottle.

Walter Kidde. New on the stand of the Walter Kidde Co., Ltd., this year was a lightweight oxygen installation for Elliotts of Newbury, designed to be fitted in Olympia sailplanes. This equipment incorporates three bottles, has a two-stage regulator valve, and weighs approximately 9 lb. A selection of glass-fibre pressure containers, and other lightweight oxygen equipment, were also included.

Tiltman Langley. Although not an official company project, an attractive-looking light aircraft, the Titmouse, is at present being designed by a group of design-office enthusiasts at Redhill in their own time. An ashtray-mounted model was quietly in evidence on the company's stand at Farnborough.

Plessey. An actual example of an exceptionally neat ram air-turbine (wholly developed by Plessey) is being shown for the first time. Intended to provide emergency power for hydraulic powered-control systems, the design point of this turbine is 150 kt; a turbine capable of taking an aircraft right down to the runway would become impossibly large unless the stalling speed was very high. The major portions of this unit are cast in magnesium alloy and the blading has so far been made by the lost-wax process, although production blades will be close-tolerance forgings. The hydraulic pump is contained inside the central boss and the unit is small enough to be extended from a fighter without requiring any fairing when housed. A small gear pump will provide fluid de-icing. At 150 knots indicated the output is two hydraulic h.p., and at 320 knots the pump output is 4 gal/min at 3,000 lb/sq in. The unit weighs 10 lb.

Rotax. An early production type of air-turbine drive is the E.X.P. 8009, which delivers 3 h.p. at 4,000 r.p.m. at a delivery pressure typical of large turbojets at high altitude. In one application this unit drives a Walter Kidde compressor. A related product is an advanced form of air-regulated valve installed between the compressor bleed and the air-turbine to maintain constant pressure at the latter. Rotax exhibit a considerable variety of equipment associated with the distribution systems required for bleed-air accessories.

CIVIL AVIATION

MORE VISCOUNTS FOR AUSTRALIA

THAT Trans-Australia Airlines are more than satisfied with their Viscounts is indicated by their decision to place a second "repeat order." The new order, for two aircraft, will bring T.A.A.'s Viscount strength to eleven aircraft, of which five are in service, and increases the number of Viscounts firmly ordered to 236.

SABENA BUY CONVAIR 440s

AN order for 12 Convair 440 Metropolitans was announced by Sabena on September 2nd. The Belgian airline is the second in Europe to buy this improved version of the Convair-liner, featuring built-in passenger stairs, improved soundproofing and provision for nose radar; an order for 11 440s, which cost some £290,000 each, was announced by S.A.S. on August 26th. Both companies have been promised delivery in the spring of 1956 —which is no doubt the overriding reason for their choice of an aircraft with two piston engines when most of their competitors will be using Viscounts. Sabena at present operate five Convair 240s on their short-haul European services.

At the same time the Belgian company announces its decision to buy three additional DC-7Cs for delivery in November 1956 bringing its total Seven Seas fleet to nine aircraft. The new long-range aircraft will be used on both transatlantic and Congo services.

For their local services in the Congo it seems probable that Sabena will postpone the problem of replacing their DC-3s by replacing the 1,200 h.p. Wasps with 1,450 h.p. Twin Wasps. The primary purpose of this modification programme is to permit continued operation to higher performance standards. Certification flight tests of the Sabena DC-3 with R-2000-D5 Twin Wasps were completed recently at the official French flight test centre at Bretigny. Results of the trials are described by Sabena as follows:—

"Very satisfactory results were obtained. At a take-off weight of 28,000 lb the second segment climb requirement ($0.35\ V_{S1}^2$) is satisfied up to an altitude of 1,800ft. The adoption of a Sabena-designed rudder spring tab resulted in a minimum control speed equal to that of the standard DC-3, without otherwise affecting the flight characteristics of the aeroplane. The spring tab design is a definite improvement over the geared tab tried previously, also a Sabena design. This is due to the directional control characteristics of the standard DC-3, which preclude the installation of a powerful geared tab. . . . Meanwhile a new series of tests is to be run with Goodyear disc brakes, in order to improve the deceleration performance."

B.O.A.C.'s FORWARD PLANS

AT the Press conference preceding publication of B.O.A.C.'s annual report for 1954-55 (summarized in *Flight* for September 2nd), Sir Miles Thomas outlined the Corporation's hopes for operating new long-range routes when the Britannia 300 L.R. enters service. Sir Miles said:

"We are now entering in the era of really long range aircraft and the capabilities of the Bristol Britannia 300 L.R. assume particular importance. When I spoke at the S.B.A.C. Annual Dinner four years ago, in 1951, I forecast our plans and hopes for the high latitude westabout route from London to central Canada and on to Tokyo *via* the Aleutians. What is known as the Polar route between Europe and the west coast of the North American continent is to-day actually being flown by airlines, notably the Canadians and Scandinavians. We have been debarred so far from so doing by lack of suitable equipment. But it is still a firm intention.

"In B.O.A.C. we are also looking eastabout on high latitude Great Circle routes and in this respect the change in relationships with Russia and the Western powers bears considerable significance. From London to Tokyo, through Moscow and Mukden or Peking, is approximately 6,500 statute miles compared with 10,150 *via* the normal Pakistan - India routing, a saving of over 3,500 miles—which is considerable. It is also shorter by more than 2,000 miles compared with the so-called Polar routing over Greenland and the North American continent.

"Again from London to Hong Kong, *via* Moscow, Afghanistan, Delhi and Calcutta, saves 1,250 miles compared with the present route through Karachi. Even if the shortening of the run from London to Sydney is not so dramatic by going over Moscow, for there is only about 500 miles difference in this case, it is obviously worthwhile to tap a new traffic point if international trade with Russia builds up. The Russians and Chinese airlines already operate ten services weekly between Moscow and Peking on a sector basis.

"These figures alone show the importance to B.O.A.C. of really long-range British aircraft. The trans-continental run eastwards of Moscow is more than the equivalent of the westwards transatlantic crossing in terms of range.

"It is not without interest at this moment to observe what would have been our operating pattern at the present time had the Comet programme continued as planned and the Britannias been delivered to us as originally forecast. Today we should have been operating Comet Is to South Africa, Aden, India and Malaya, and Comet IIs to South America, Australia and the Far East. Britannias would have been already operating on first and tourist class services to West Africa, East Africa and Canada. And we should have been making really decent profits.

"It is indeed a sobering thought that although the Atlantic is being flown at half-hourly intervals all round the clock, there is still no British aircraft on that route. The magnificent performance of the Canberra in doing the London/New York/London round trip in one day is, of course, most encouraging, but the Canberra is a bomber and as far as I know there is no worthwhile trade in bombs as between this country and the United States.

"Our hopes, indeed our whole future as a long haul international airline, lie in the punctual fulfilment of the Britannias and Comet IV programme. And with that goes the future of our aircraft industry as makers of that extremely important class of aircraft."

Other subjects on which Sir Miles Thomas cast new light included the following:—

Future jet services: B.O.A.C. did not intend to operate the Comet 4 on transatlantic services; it would be employed on the eastern routes. The Corporation was, however, "awaiting a proposal from Vickers" as to the VC-7. Referring to his estimate, in the printed report, that some three years would pass before the Comet returned to service, Sir Miles said: "I would put that as a minimum figure."

South American services: The date of B.O.A.C.'s resumption of services depended very much on the Britannia; it was no good going back to the route without a dominating aircraft. Services would begin when the Britannia was "grooved in" on the South African and Eastern routes.

Commonwealth round-the-world route: When suitable aircraft were available the Corporation would make use of its landing rights at San Francisco, linking up there with the Qantas transpacific service to Australia and thence back to Britain *via* the East. Initially, B.O.A.C.'s services would turn round at San Francisco; later on, they might fly on to complete the global circle [presumably under an interchange agreement with Qantas].

Present progress: In the 19 weeks following the end of the period covered by the report B.O.A.C. had earned 14 per cent (£1.9m) more revenue than in the corresponding period last year—"a very healthy state of affairs," concluded Sir Miles.

AIR SERVICE AMENDMENTS

THE Minister of Transport and Civil Aviation, after considering the recommendations of the Air Transport Advisory Council, has approved the following applications for amendments to air services:

B.K.S. Air Transport, Ltd.—The inclusion of an optional traffic stop at Leeds and a technical stop at Southend on their inclusive tour service between Newcastle and Paris.

Skyways, Ltd.—The inclusion of optional traffic stops at Manchester and Birmingham on their inclusive tour service between Liverpool and Tarbes (for Lourdes).

STORM-WARMING RADAR ORDERS

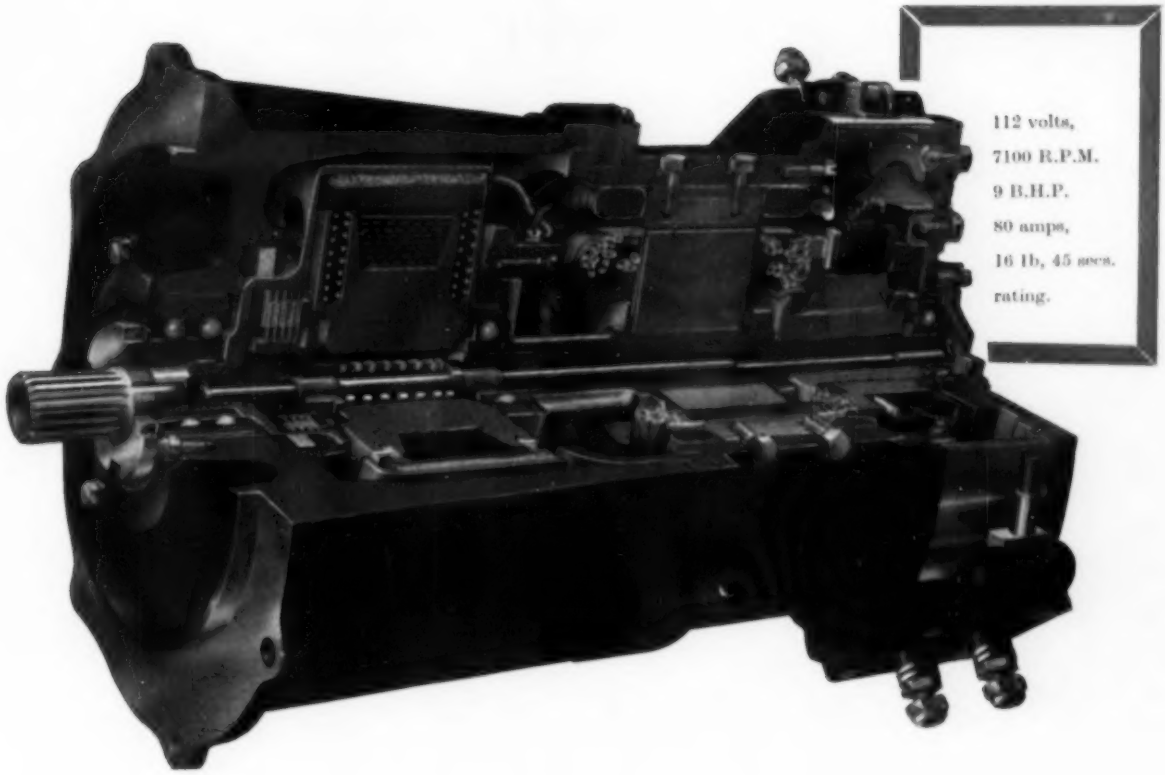
THE adoption of nose-mounted radar, for improved safety, comfort and economy of operation in turbulent cloud, has been announced by two European airlines. For their new Britannia fleet, B.O.A.C. will use Ekco storm-warning radar equipment operating on a wave length of 3 cm at ranges of up to 120 miles. In addition to its primary function of storm warning the equipment can be used for map-painting and for indicating high ground. A feature of the Ekco radar is a "high brightness" cathode-ray tube enabling the display to be seen in ordinary cockpit conditions without the use of a visor.

Swissair will use R.C.A. "C-band" radar, developed by the Radio Corporation of America and already adopted by four leading United States airlines, on their four new DC-7Cs, which are due for delivery between late 1956 and early 1957.

DECCA RADAR FOR VENEZUELA

VENEZUELA'S Ministry of Communications has announced the adoption of the Decca 424 airfield control radar for installation at four of the country's most important civil and military airfields. In addition, Venezuela has bought two Decca 41 storm warning ground radars to assist in the preparation of weather forecasts. Technicians from the Decca Radar organization are expected to begin the work of supervising the installations late next month.

For a comparatively new item of radar equipment the Decca 424 has been adopted on a remarkably wide scale. It has already been supplied for civil use in Britain, South Africa, India, Southern Rhodesia and Iceland and to several air forces including the



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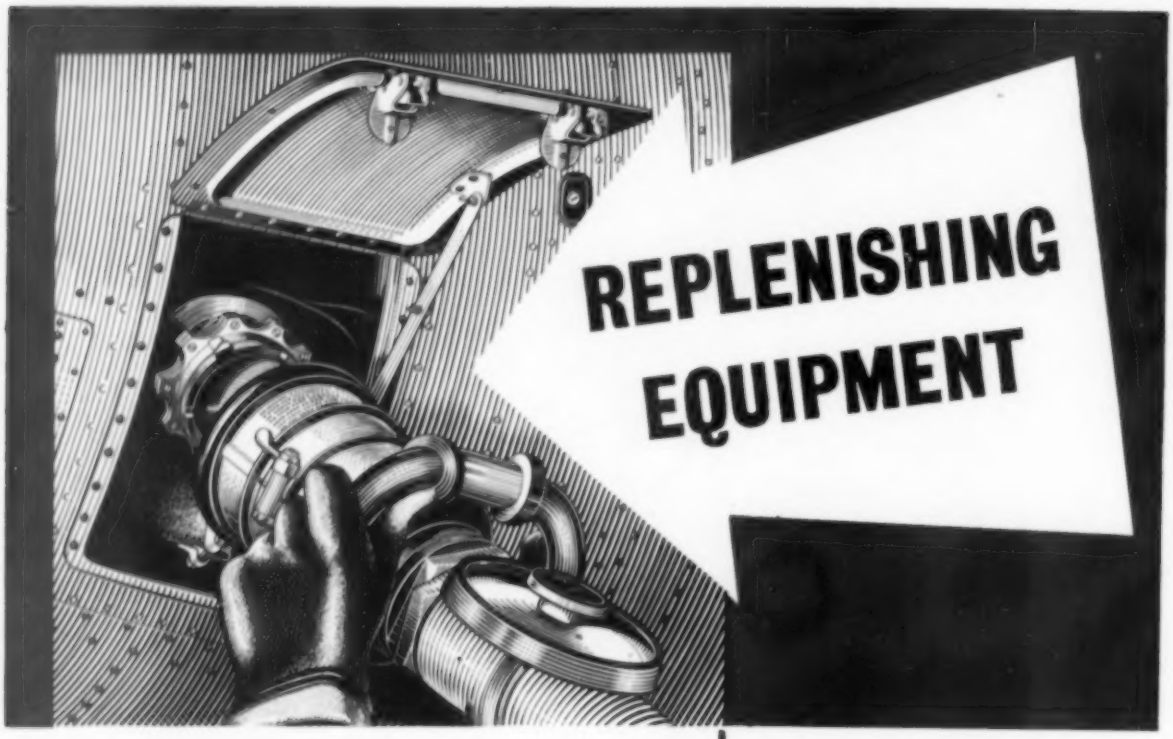

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Self-sealing Aircraft Units for connection to gallery pipes, hoses, or tank shells and capable of handling up to 500 Imperial gallons per minute of fuel.

Quick-release Hose Units for use on delivery and suction hoses to aircraft, refuellers and hydrants. Available with or without Selective Coupling.

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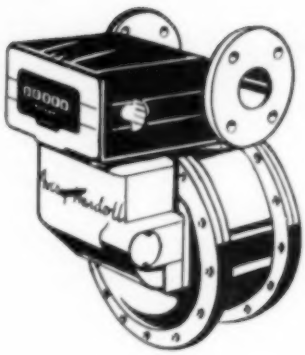
Pressure equipment for the replenishment of lubricating oils in sealed quantities without risk of oil contamination or spillage.

Equipment for replenishing with methanol-water and for use with rocket fuels and oxidants. Fitted with Selective Coupling to provide product segregation.



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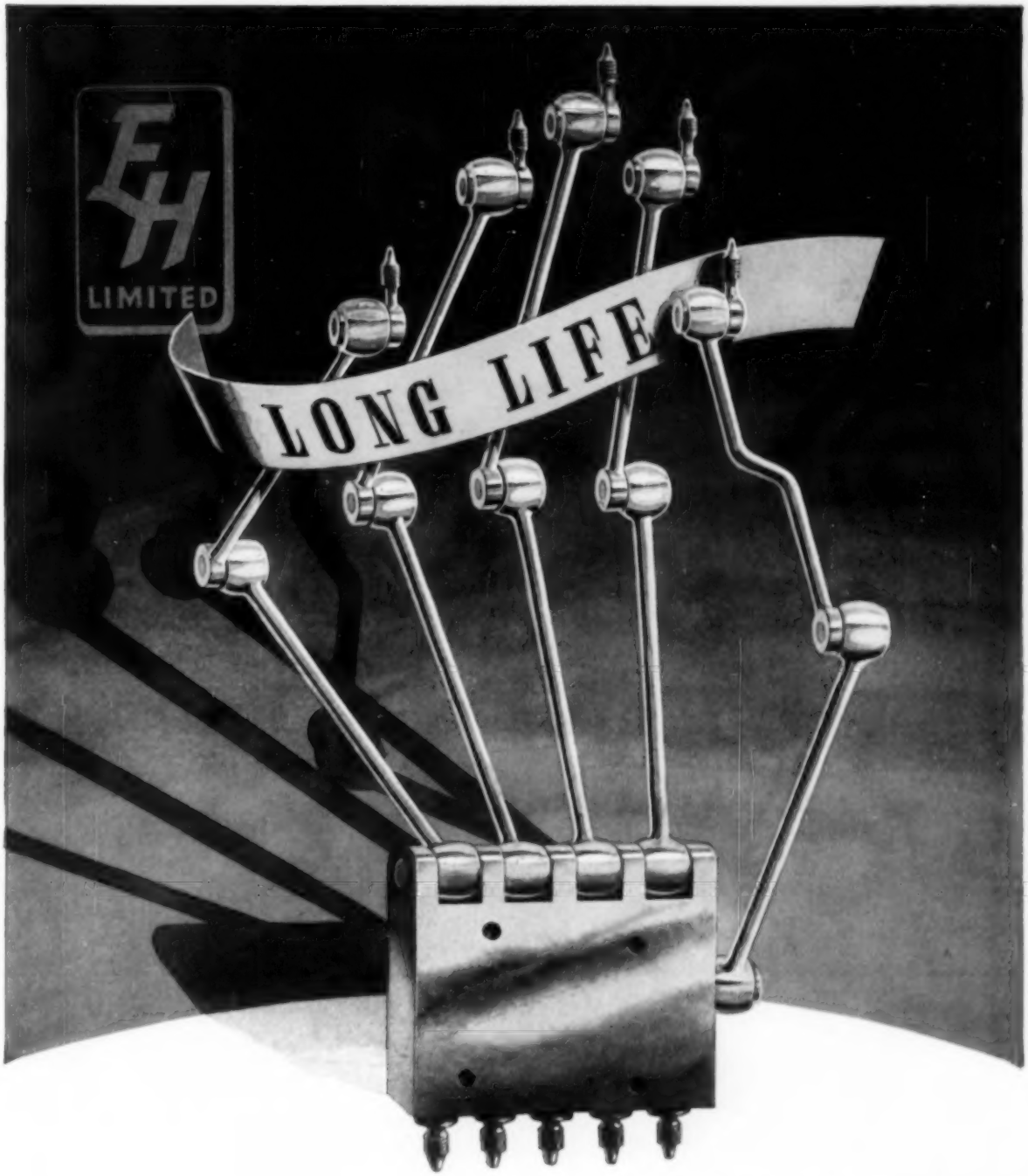

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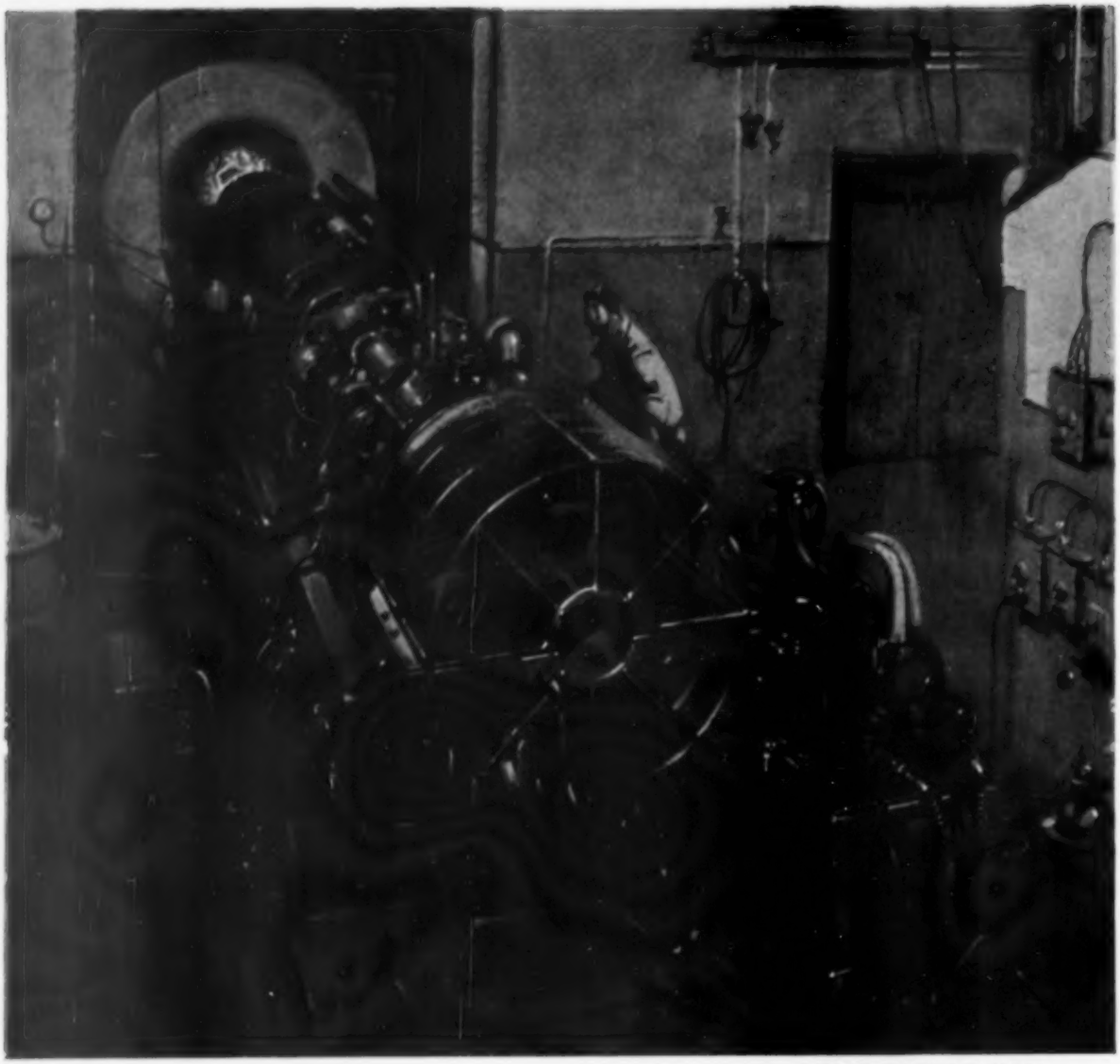


FROM A PAINTING BY CUNEO

PORTRAIT OF AN IMPORTANT CUSTOMER

This is a painting of a Rolls-Royce Avon engine
being tested at Rolls-Royce works at Derby.
It shows one of the most astonishing pieces
of machinery in the world—
a unit, which in its latest form, for all its compactness
develops over 10,000 lb. thrust.

Shell and BP Aviation Service

congratulate Rolls-Royce on their development of the Avon,
and as suppliers of fuels and lubricants they are proud
to have been associated with this development.

CIVIL AVIATION . . .

R.A.F. and U.S.A.F. The Decca 41 storm-warning radar is now in operation at six airports—Entebbe, Calcutta, Nairobi, Khartoum, Bangkok and Kano. Its ability to detect storms extending to high altitudes at ranges of up to 200 miles is, of course, of particular value in tropical and sub-tropical countries. That its use is not confined to these areas is indicated, however, by the recent installation of a Decca 41 at Victory House, London, for evaluation by the Meteorological Office as an aid of short-term forecasting of thunderstorms and rain in the Greater London area.

CORPORATIONS AND INDEPENDENTS

POLITICALLY, all seems quiet on the British air-transport front, but there are signs that the almost-forgotten party controversies will be revived before many months have passed. It may thus be timely to recall some of the essential issues before they become engulfed in a wordy torrent of doctrinaire wrangling.

In July 1952 the last (Conservative) Government introduced a new civil aviation policy designed "to help forward the sound development of civil aviation, to reduce the cost of air transport to the taxpayer and to give greater opportunities to private enterprise . . . without in any way impairing the competitive strength of our international air services."

Broadly speaking, the application of this policy was as follows: B.O.A.C. and B.E.A. retained sole rights to operate first-class and tourist services on all their existing routes, and the right to apply to operate new services; the independent airlines were offered opportunities of operating "C-class" services on Corporation routes and normal services on new routes on a long-term basis (approvals since 1952 have normally been granted for periods of five to ten years instead of one, as previously); furthermore, the Corporations were instructed not to keep aircraft specifically for charter work.

It is important to note, incidentally, that this policy was introduced without any change in the Air Corporations Act of 1949, which nominates B.O.A.C. and B.E.A. as "chosen instruments" for the operation of scheduled air services. Under Section 15 of this Act independent airlines may be appointed as "associates" of the Corporations.

The effects of the 1952 policy on the development of British operators' scheduled traffic are indicated by the following statistics:

Passengers carried in	*Corporations*	*Independents*
Financial year 1952-53	1,675,000	124,000
" " 1953-54	1,873,000	245,000
" " 1954-55	2,155,000	345,000

It will be seen that both state and independent companies have experienced considerable increases in traffic, and it is widely accepted that the rise of the independents has not been at the expense of the Corporations. As evidence, the following extract from B.O.A.C.'s annual report, referring to recent co-operation between the Corporation and three independent carriers, may be quoted:

"It is thus clear that significant progress was made during the year in implementing the Government's policy of finding increased scope for the enterprise and initiative of British independent companies in a manner complementary to that of the Corporation. The management ability of the independent companies as well as of the Corporation is being given free rein; moreover, provided collaboration is developed on these lines, the internationally competitive power of the Corporation far from being weakened can in fact be strengthened.

"The Corporation trusts that the progress already achieved within the framework of the present Act can be regarded as substantial. The experience of the Corporation indicates that further progress can be made within the scope of this Act without any alteration of substance other than the necessary changes which flow from the expiry of the provisions for financial assistance."

The second paragraph may well have been written in anticipation of a demand for modification of the Act. The present Government, being more firmly established than its predecessor (and thus better capable of tackling the task of introducing new legislature), might meet such a demand more sympathetically. So far, however, it has remained inscrutably non-committal on the subject.

When the question is once more raised the independents will undoubtedly point to the fact that the improvement in their fortunes has been mainly on short-haul routes, and that on a ton-miles basis they are providing only six per cent of the total capacity offered on all British scheduled air services. In requesting a "larger slice of the cake," the independents are unlikely to demand radical changes in policy—i.e., abolition of the principle of State-owned air Corporations. Nor will their manifesto display any political content, for the future of private air transport depends on a reasonable chance of survival in the event of a change of Government. Instead, the independents' case will be based on the argument that Britain will lose her rightful place in world air transport if all initiative on major routes is left in the hands of State monopolies.

BREVITIES

ON the London-Paris route, which Air France have been operating exclusively with Viscounts since November 1953, the French airline's share of total traffic is reported to have increased from 38 to 45 per cent. During the first six months of 1955 the Air France Viscount passenger load factor on the route averaged 76 per cent, compared with 49 per cent in the pre-Viscount era.

* * *

A fifth weekly freight service between New York and Europe was introduced by Pan American on August 26th. Operated by both DC-4s and DC-6As, the American airline's all-cargo flights now serve eight traffic-centres—London, Brussels, Amsterdam, Shannon and four German cities. Including freight services, P.A.W.A. are now operating 116 transatlantic crossings weekly.

* * *

Philippine civil aviation authorities withheld take-off clearance from an Air-India Constellation which made a non-scheduled landing at Manila on August 31st. It was alleged that the captain of the aircraft—who diverted to Manila when, on a regular flight from Tokyo to Hong Kong, he was prevented by bad weather from landing at either Hong Kong or Okinawa—had "violated landing regulations."

* * *

A Hiller 360 of Fison-Airwork, Ltd., has been chartered by the Sui Gas Transmission Company, Ltd., of Pakistan, for inspection and maintenance duties along the 370-mile pipeline conveying the natural gas from Sui in Baluchistan to Karachi. The terrain through which the pipeline passes makes surface transport almost impossible at certain seasons and very slow at best; the helicopter will enable faults to be repaired and located within hours.

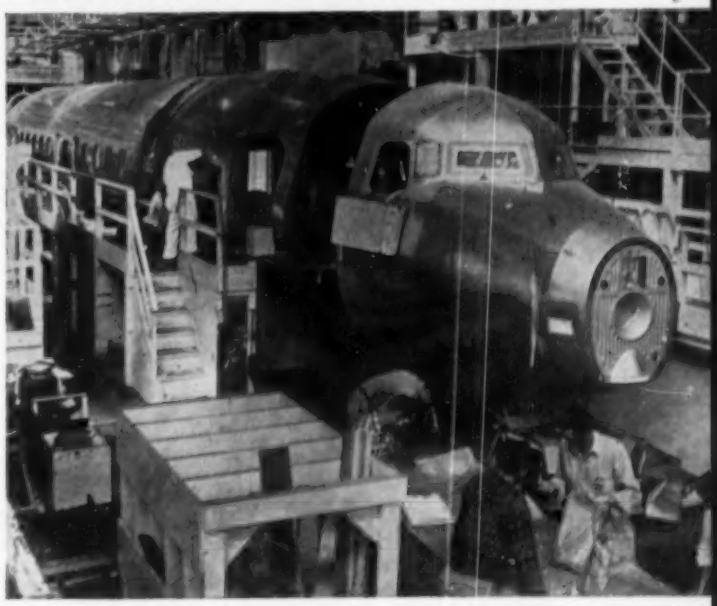
* * *

Proposed amendments to the 1929 Warsaw Convention are being discussed at an I.C.A.O. conference which began at The Hague on September 6th. The Convention limits the liability of an air carrier to £2,960 for each passenger in the event of injury or death during an international flight; the major change proposed consists of raising this limit by 60 per cent to £4,740. The United Kingdom's six-man delegation is headed by Mr. A. H. Wilson, Under-Secretary, M.T.C.A.

* * *

Moscow radio reported last week that an air-traffic agreement had been signed between the U.S.S.R. and Yugoslavia. Under its terms routes established between the two countries will be served by Yugoslav and Soviet aircraft on a reciprocal basis. The agreement was signed on behalf of the Soviet Union by the head of Soviet Civil Air Services, Zhavoronkov, and on behalf of Yugoslavia by Dragoje Djuric, representing the Yugoslav Foreign Ministry. Details of the services are to be announced later.

Fuselage assembly of the first Douglas Seven Seas is shown in this recent picture from Santa Monica. The aircraft is "slated to roll out of the final assembly hanger" early in November and to fly by December 31st.



DERBY TURBOPROPS

The Plesman Memorial Lecture, Sponsored by I.A.T.A. and Delft University: a Digest

CIVIL aviation lost its greatest personality on December 31st, 1953, when Dr. Albert Plesman died suddenly at the age of 63. Plesman was primarily responsible for the formation of K.L.M. Royal Dutch Airlines in 1919, and the size and status of the airline today are the results of his vigorous, far-sighted leadership of the company up to the time of his death. His honorary degree of Doctor of Science was conferred upon him in 1947 by the University of Delft, when it was observed that his thesis consisted of three letters—K.L.M. In practice of his belief that "The air ocean unites all peoples," Dr. Plesman played a leading part in international aviation affairs, and he was a founder and three times president of I.A.T.A. Himself a pilot (he qualified for "wings" as a Dutch Army lieutenant in 1918), Plesman lost two of his three sons in flying accidents.

ON Monday last, the first Dr. Albert Plesman Memorial Lecture was read in Amsterdam. The author was Mr. J. D. Pearson, managing director of Rolls-Royce Aero Engine Division. He pointed out how apt was the subject he had chosen, *The Development and Future of Turbine Engines for Airline Aircraft*. Not only had Dr. Plesman himself always shown a great interest in gas turbines, but the great airline of which he was the founder and, until his death in 1953, the president, had recently purchased Vickers Viscount transports powered with gas turbines made by the lecturer's own company.

Mr. Pearson went on to trace the history of gas turbine engines. He described an early Rolls-Royce design, the CR.1, design work on which was begun in September 1940. This engine, which first flew on test in 1942, giving 350 lb thrust, was overtaken by the classic work of Whittle. Within 12 years of the first flight of the first Whittle engine (in May 1941) 17,000 centrifugal jet engines of Rolls-Royce design alone had been manufactured and were in service.

The lecturer went on to speak of the Trent, the first turboprop in the world to fly; the Clyde, a 4,000 h.p. turboprop which was abandoned in 1948 after 3,250 hr of bench development, the Dart; the de Havilland Comet, and the Avro Jetliner.

The development of a civil turboprop aero engine was next described by Mr. Pearson in terms of his company's experience with the Dart (see Fig. 1). The broad conclusion to be drawn from this experience, he said, was that there was a natural gestation period which could not easily be shortened. The benefits of past experience and accumulated knowledge were balanced by increasing complication and difficulty.

The first Dart engine flew in 1947 as a single installation in a four-engined flying test-bed. This was later augmented by a twin installation in a Wellington, which was later replaced by two engines in a Dakota. By the time the first regular passenger service began in April 1953, these aircraft had accumulated 1,658 engine hours. Some of this early flying was concerned with understanding the basic problems of controlling a turboprop, but the remainder referred to conventional routine development flying, involving control problems, engine calibration and fuel-system development.

Approximately 400 flying hours were taken up in developing the de-icing system of the Dart to its present standard. A special water-spray grid was used on the Lancaster flying test-bed during this work. In order to assist in the development of satisfactory de-icing of the rotating blades, the Rolls-Royce company utilized a rotor icing rig in which a single stage of rotors could be run at engine speed.

The problem of flight endurance testing was a major one in connection with an engine, such as the Dart, having no prior military background. Before the Viscount entered regular passenger-carrying service, the Dart had accumulated 14,500 flying hours, of which 9,000 had been obtained on the two Viscount prototypes—an unusually high figure. Both Viscount prototypes did a certain amount of preliminary route-flying and, in addition, two Dart Dakota freighters were operated by B.E.A. for some 4,000 hr.

Although a proportion of this flying was concerned with gaining basic knowledge about the turboprops, it was felt that a similar number of flying hours was necessary before any entirely new engine went into passenger-carrying operation. One of the difficulties of obtaining the necessary flight-endurance testing was the high cost, and so a method must be devised for obtaining some useful work during this endurance testing, preferably by means of freight-carrying by the airline operator.

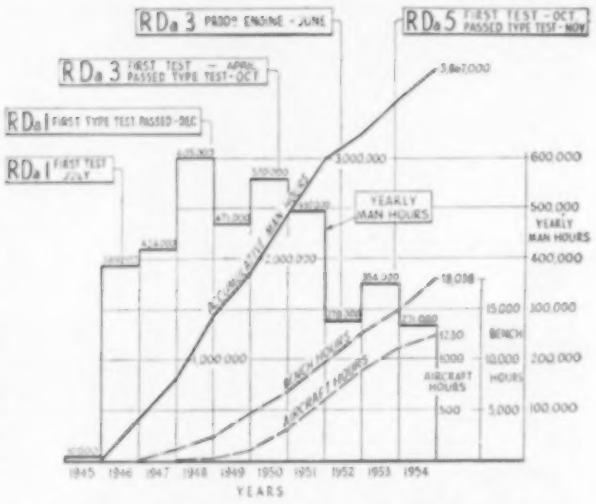


Fig. 1. Time required to manufacture and develop Dart Turboprops.

One basic advantage of turbine engines was the ability to use fuels which entailed less risk of fire on the ground. The fire risk, however, had not been removed completely, because of the large areas of hot metal surface in turbine engines. Experience had shown that in many cases it had been the small details which had let the system down, and this led the lecturer's company to build a fire tunnel in 1950. In this a complete engine nacelle and associated wing structure could be mounted and a fire could be started with a tunnel airflow simulating the aircraft speed.

The tunnel had proved invaluable in the development of fire extinguishing systems and for the correct zoning of turbine engines. An additional and important use had been to establish minimum ventilation flows in various zones, for it must be remembered that ventilation was paid for in fuel consumption through the drag involved. In this connection the by-pass engine was notable, for here the hottest components (combustion chambers and turbines) were completely surrounded by a blanket of cool air in the by-pass duct, thus giving ideal insulation and ventilation with no extra drag.

Concerning performance rig testing of components, the gas turbine engine responded far more readily than the piston engine because it was easily separated into compressors, combustion system and engine turbines. Unfortunately, the power requirements on test at sea-level conditions were considerable—for example, the Avon compressor would take 25,000 h.p. at sea-level—and in the past this country had tended to accept lower powers by resorting to scale tests or tests at altitude conditions.

The advent of supersonic speeds and high altitudes had presented engine designers with new problems in the development of engines for high performance aircraft, and it was obviously desirable to test engines under these conditions. Flight tests could provide much useful information but were restricted for such reasons as loss of time during unsuitable weather conditions; lack of suitable aircraft when the tests were most required; the restricted risk that could be taken with a flight engine; and the difficulty of making sufficient quantitative test observations in flight.

The alternative was a ground test plant capable of simulating the appropriate conditions for a complete engine. Rolls-Royce were building such a plant which would not only be capable of complete turbojet and turboprop engine tests, but would also provide "suck and blow facilities for a variety of other purposes, such as a wind tunnel to test models at Mach 4, full-scale combustion system tests at both high and low pressures and full-scale compressor tests."

Turning to the subject of mechanical rig testing, Mr. Pearson emphasized that, in the past, there had always been a tendency for rigs to follow the engines, and often for them to be brought into use only when a serious mechanical trouble had appeared during development. Such rigs, however, had proved so useful that it was becoming quite common to develop, build and run them ahead of the first prototype engine. In the case of the RB.109, 27 miscellaneous rig tests were carried out before the first engine ran; 22 of these were major rig tests, including 11 running rigs. These were quite independent of the normal compressor, turbine and combustion rig tests, all of which were under way before the first development engine was available.

Civil engines must behave satisfactorily over a wide range of

42 Passengers and their personal luggage . . .

plus 3 private motor cars . . .

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DERBY TURBOPROPS . . .

climatic conditions. The company possessed a low-temperature test-house in which complete engines could be started and run for short periods down to −40 deg C. Hot conditions did not seem to give so much trouble and were covered by tropical flight trials.

In addition to the general metallurgical development which was going on to produce better materials which would withstand higher temperatures for longer times, and from which the civil engine would benefit, certain work of specific value to civil engine development could be done. The metallurgical laboratory could also be very helpful in carrying out long-life fatigue tests on complete components such as compressor blades.

Inherent turbine engine problems were next considered by the lecturer. A great deal of thought and testing, he said, had been devoted to possible flight failures unique to gas turbine engines. Firstly, it was reasonable to expect that at some time a compressor-blade or turbine-blade failure would occur in flight, and so such a failure must be contained within the engine and not lead to subsequent catastrophic failure. In axial compressors the problem was eased by the use of aluminium blades in the early stages.

The detail design of turbines must be such that a single turbine blade failure in any rôle fulfilled these conditions. In general, this meant the provision of a sufficiently tough skin around the turbines and for some distance downstream, which could only be determined by test. It might also necessitate the provision of a special device enabling the pilot to pick out quickly which engine had suffered a blade failure and so shut it down.

The centrifugal compressor rotor was in rather a different category but by adequate inspection and corrosion protection, coupled with a thorough understanding of the effect of life on fatigue strength, it should be possible virtually to eliminate such failures in flight. It should also be possible to design centrifugal-compressor engines in such a way that a burst rotor would be contained within the engine, by making use of a strong diffuser suitably attached to the main structure of the engine.

One of the most serious failures which could occur would be the bursting of a turbine disc. This could happen if the engine ran away to the bursting speed, or at normal engine speeds if the disc contained a defect. It was necessary to ensure that the engine would not overspeed dangerously under all conditions of internal failure which might occur, such as those which would disconnect the power-producing section from the power-absorbing section, or control unit failures which might put the airscrew into fine pitch. A high standard of inspection should ensure the absence of initial defects in the discs, and good design should ensure that defects, such as fatigue cracks, which might develop during service would not lead to bursting of the disc.

Clearing an engine for the various degrees of overspeeding which could occur with certain types of mechanical or control failure involved a great deal of special testing which in many cases must be carried out to destruction. Many hundreds of hours of special testing had been carried out on the Dart to develop this aspect of the engine alone, and an extensive programme of this nature was essential to the development of any new civil gas turbine.

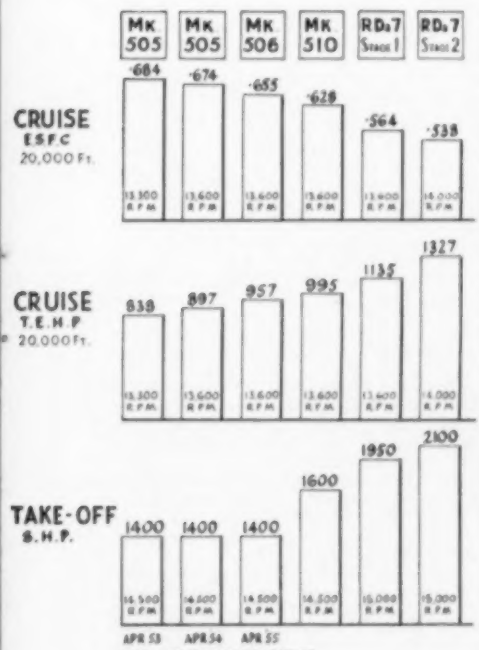


Fig. 2. Dart performance development.

Describing service experience with the Dart, the lecturer showed a diagram (Fig. 3) giving statistics of failures in service together with the increases in engine overhaul life. Concerning reliability, a crop of minor mechanical troubles with the reduction gear had occurred, of the sort that seemed to appear only when engines actually came into service. During this initial period there were virtually no troubles with the essentially gas turbine parts.

There followed a period of relative freedom from trouble until the failures associated with running time began to appear in the early part of 1954. One of these was turbine-blade failure traced to a resonance at the low-speed end of the running range and aggravated by a slight change in blade design. By a combination of dealing with this minor design feature and avoiding the particular low-engine speed where resonance occurred, this trouble had been virtually eliminated.

Concerning durability, the gas turbine engine posed a new problem in assessing the ultimate life of those major components subject to fatigue, the failure of which could endanger the safety of the aircraft. In order to assess the ultimate life of such components, Rolls-Royce were endeavouring to develop rig tests which would produce typical failures in them, and then to repeat the tests on components after various running times in the engine, thus obtaining a measure of the extent to which running time reduced the fatigue life. Until such tests were established on a firm basis there would be an inevitable tendency to keep the lives of such components well within those established by actual engine running.

"There is every reason for the overhaul life of the Dart to be extended beyond the present figure," Mr. Pearson continued, "But we are handicapped in doing this by the relatively short life of the longest-life engines, none of which exceeds 2,500 hr. My personal view is that the Dart is doing better than it ought to be doing and that the engine still has some troubles locked away inside it which it is being reluctant to reveal."

One feature of the gas turbine engine in which predictions had been fully justified was the very low maintenance costs. The repair of gas turbine engines, in addition, should present no particular difficulties to an operator who repaired his own piston engines. The main differences between repair work on piston engines and on gas turbines were the needs for dynamic balancing equipment for the rotating parts and a certain amount of special inspection devices, including processing equipment. There was rather more sheet metal work repair in gas turbines than with piston engines, particularly on items such as flame-tubes.

Fortunately, the turboprop lent itself well to continued performance development. This was due to its shaft h.p. being the difference between the power developed by the turbines and the power required to drive the compressor, with the result that any gain in efficiency of these components was multiplied when expressed as a percentage increase in s.h.p., or decrease in s.f.c.

Apart from improving the power and reducing the specific consumption by improved efficiency of the components, improvements could be made by increasing the cycle temperature. There was little doubt that the intensive development now proceeding on air-cooled turbine blades and air-cooled nozzle guide vanes would lead to continuous performance development of existing turboprops for some considerable time to come.

The picture for the performance developments of existing turbojet engines was rather different. Although the thermodynamic efficiency of the cycle still increased with increasing temperature, this was more than offset by the decreasing propulsive efficiency of the jet. Thus with the simple turbojet the optimum specific fuel consumption was obtained at a much lower flame temperature at subsonic forward speeds than that at which the engine must be designed to obtain a good thrust/weight ratio. This meant that the specific consumption of a turbojet could not be improved by the use of increased flame temperatures. This left open the possibility of improvements by increased efficiency of components and by raising the compression ratio.

The by-pass engine was a sort of "half-way house" between the turboprop and the turbojet and had, in fact, come into existence as an attempt to counteract the falling propulsive efficiency of the turbojet with increasing temperature. It possessed the ability to take advantage of the higher cycle efficiency by operating at a higher turbine-inlet temperature, combined with an improved propulsive efficiency derived from a lower jet-pipe temperature.

Dealing with some specific technical considerations, the lecturer mentioned first the question of reverse thrust. With a piston engine, he pointed out, it was necessary to reverse the airscrew pitch and run the engine to obtain significant drag. A single-shaft turboprop handled a large amount of excess air and so a considerable amount of drag was available simply by allowing the airscrew to windmill and drive the compressor. On the Dart this provided a significant reverse thrust during the high-speed part of the landing run.

On a turbojet, reverse thrust could only be obtained by physically deflecting the jet into a forward direction. It seemed that a reversal of 45 deg would be adequate as this permitted up to 70 per cent of the rated engine thrust to be obtained in reverse.

The use of adjustable reverse thrust opened up some interesting

DERBY TURBOPROPS . . .

possibilities as it should enable the engine to be run at full r.p.m. so as to provide the maximum service for anti-icing and flap-blowing and at the same time control the net thrust on the aircraft by adjusting the reversing nozzle. Such an arrangement also opened up the possibility of making a landing approach with all engines running at full power so that, if the aircraft had to go round again, full forward thrust was instantaneously available merely by moving the reverse thrust eyelids and without having to wait for the engines to accelerate. The uses of such a system on military aircraft were obvious, and the lecturer believed that this principle was close to being an essential feature for the operation of large jet aircraft.

Increasing complication, while disliked by the operator, appeared inevitable. In order to get improved consumption, higher compression ratios must be used and, to obtain these at reasonable compressor efficiencies, it had been necessary to desert the relatively simple centrifugal compressor for the axial type and then to go to a two-shaft installation to obtain the highest compression ratios. On the turbine side, the demands of increasing efficiency had led to multi-stage turbines, while the various sealing arrangements through the engine had become increasingly complicated in the interests of reducing leakage losses and thus improving specific consumption.

As a simple example of the unfortunate but inevitable process of complication, the Derwent engine had 9,000 parts, the Dart 12,000, and the RB. 109 a total of 20,000. Basically, this increased complication had been forced on the company by their endeavour to make the engine meet more suitably the requirements of its environment in the aircraft and in particular the requirements of improved fuel consumption, less frontal area and less weight. The RB. 109 would give nearly three times the power of the early Darts, although of the same overall diameter and weighing only 50 per cent more. A fundamental difference between piston engine and gas turbine was that the compression ratio of the latter, which was still the basic factor affecting fuel consumption, fell with decreasing engine r.p.m., with the result that the cruising r.p.m. needed to be as high as possible from an engine efficiency point of view. This unfortunately cut right across the requirements for low airscrew noise.

Strenuous efforts must be made in the design of the engine to obtain the maximum possible spread in r.p.m. between take-off and cruise without sacrificing specific consumption. At present the best that could be done in this direction would not give as wide a spread in r.p.m. as normally existed in piston engines, unless a free-power turbine were used, but this had other disadvantages for high-compression engines.

If a reduction gear ratio and airscrew diameter were chosen to give what was considered to be an acceptable helical-tip Mach number from the noise point of view then, compared with present-day piston engine practice, the airscrew would be turning too slowly for take-off. Fortunately the requirements of high forward speeds led to engines of a power which, by piston engine standards, gave excess output for take-off. This meant that, in aircraft which cruised at high speeds, there would always be plenty of power available for take-off. The limitation in take-off thrust would then be in the airscrew itself and thus the engine designer would be brought under pressure to overspeed his engine at take-off: pressure which, for obvious reasons, he would resist.

For certain long-range aircraft the excess power available at take-off might lead to engines which were virtually throttled at take-off. In fact, as the power of existing turboprops was increased there would be a general tendency for this to happen when the important requirement was an increased cruising speed. These considerations applied essentially to four-engined aircraft. For twin-engined aircraft the excess power available was usually welcomed in order to meet the single-engined case for take-off and climb and to enable the aircraft to use shorter runways.

On the question of "turboprops *versus* turbojets," Mr. Pearson suggested that the turbojet transport would have greater passenger appeal on the scores of both comfort and speed. The turbojet, when re-established, would increasingly invade the field of the turboprop airliner, in the lecturer's opinion, particularly for first-class travel. This would be so provided the airport noise of turbojet transports could be reduced to an acceptable level.

Apart from noise considerations, the limit of the invasion of the turboprop field would be determined by the overall economics, taking into account the effect on load factor of passenger appeal, as well as the seat-mile cost. It thus seemed unlikely that the pure jet would come into the short-range picture within the foreseeable future, but some invasion of the medium-range field was probable. In the long-range sphere the turboprop would need to fight hard to retain its place, and might only do so if it could provide very much cheaper seat-mile costs.

Turning to the future needs of air transport, the lecturer dealt first with the subject of turboprops during the next five years. This period, he said, would see the emergence of the high-

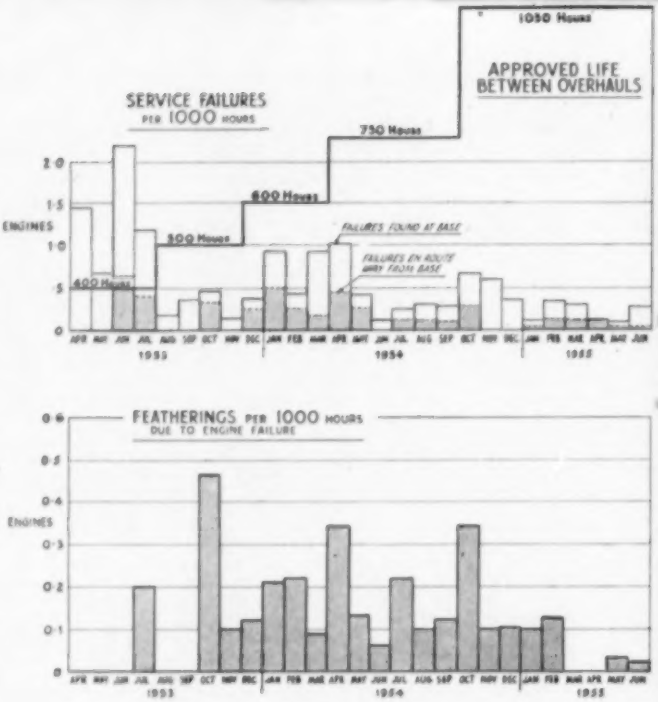


Fig. 3. Dart service experience.

compression-ratio, two-shaft turboprop which, with its improved fuel consumption, would tend to make existing single-shaft engines obsolete. The rival virtues of high and low compression ratios were much the same in turboprops as in reciprocating engines. Civil aircraft would probably use high ratios in only the larger sizes of aircraft, for the following reasons: (1) well-established and low-cost small engines already existed; (2) emphasis on fuel consumption was not so great over shorter distances; and (3) first cost was normally more important in the smaller engine.

The aircraft designers during this five-year period would welcome increased powers from existing engines, as they always had done. The period would see the introduction of medium- and long-range turboprop aircraft, and also the introduction of twin-engined turboprop aircraft, of which a typical example was the Fokker Friendship. Because of the low powerplant weight, coupled with the relatively high powers available for take-off and climb, the lecturer believed the turboprop to be particularly suitable for fast twin-engined aircraft. These features, he submitted, coupled with the increased reliability, might lead to a revival in popularity of the twin-engined aircraft, where cost of operation was paramount.

Numbers of turbojet engines at present under development for military purposes should be available for civil use during the next five years, and the civil aircraft designer should have a considerably wider choice than with turboprops. He would be restricted, however, by the engines available in the particular size required, and at the particular time required, rather than by theoretical considerations of ideal size and type.

Turning to the long-term picture, the lecturer concluded:

"The path ahead of the propeller turbine is, from a technical point of view, the straightforward one of improving the overall efficiency by increased efficiency of components and development to permit higher flame temperatures, together with a continuing reduction in specific weight by getting more power out of the same size of engine.

"How far down the scale of size the two-shaft axial engine can profitably be carried is a debatable point which will have to be resolved.

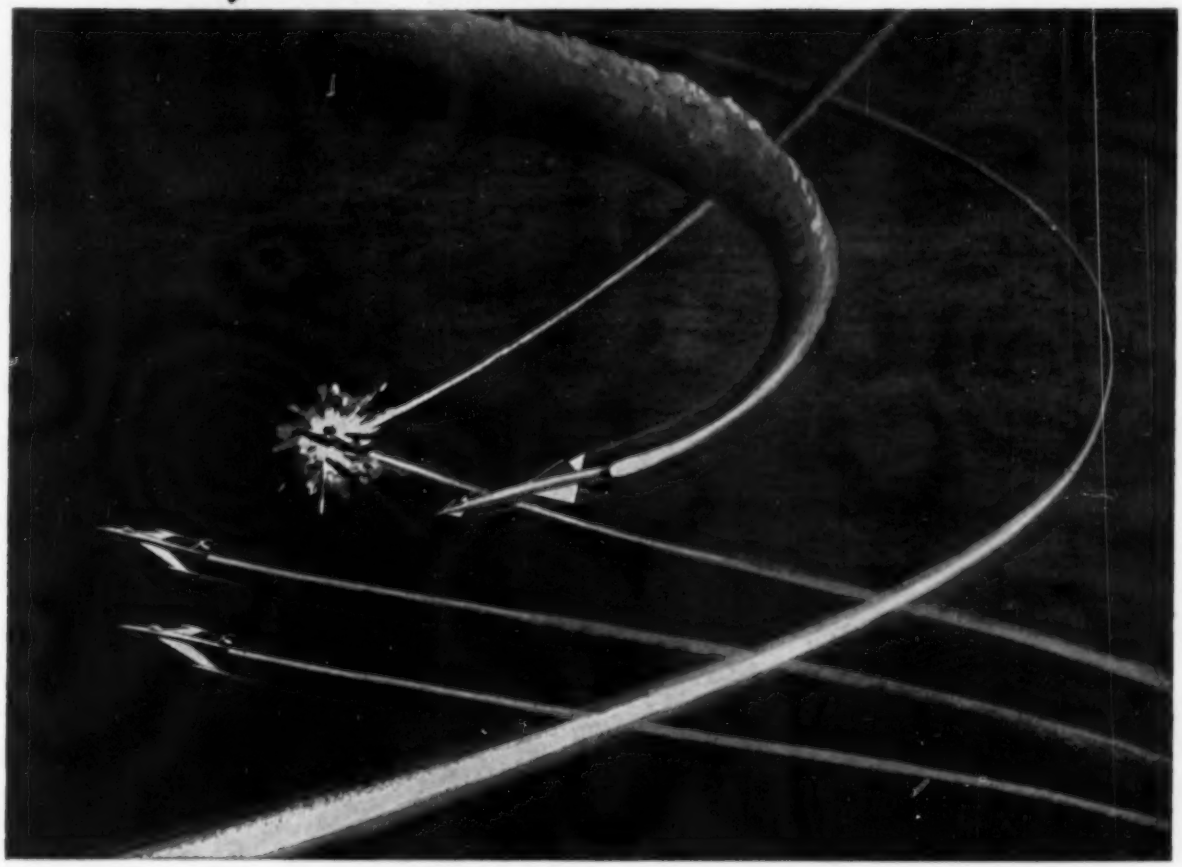
"Far more important from the engine manufacturers' point of view is the point that has been touched on earlier—where will the jet engine take over from the turboprop? As mentioned previously, my own feeling is that by force of public preference the jet engine will invade the turboprop field.

"On the turbojet side there is no sign of a slackening in military demands for more power at higher speeds, and the pace is likely to be governed by the pace of military developments.

"Supersonic flight has arrived and I see no reason why supersonic transport will not one day follow.

"The problems are enormous, but that is only a good reason for getting started on them. I can assure the aircraft manufacturers and the operators that when they are ready for supersonic civil transports the engine industry will certainly be ready with suitable engines, both to propel them and, if necessary, lift them off the ground."

Today and Tomorrow...



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Ten of the twelve Valiants of No. 138 Sqn., Wittering, which carried out fly-posts during the S.B.A.C. Show, make an impressive line-up at their base. The three Canberras are T.4s.

C.F.E. Hunters Return

ON August 31st the team of Hunters from C.F.E., West Raynham, returned from a most successful tour of the Middle East. They had flown 5,500 miles, not including an additional flight to Amman and Habbaniyah, and the aircraft, all Hunter Mk 1s, had behaved extremely well. Even with the short endurance allowed by the smaller tankage of the Mk 1 there had been no difficulty. The longest hop had been 337 miles between Eskesehir, Turkey, and Ellenikon, Greece, which had taken 50 minutes. Between Italy and Greece, on the outward flight, a strong following wind had given them a ground speed well over 700 m.p.h. Flying time to Cyprus was just under 4.5 hr.

Ten pilots and eight Hunters were engaged on the tour, and the formation was led out to Cyprus by the Commandant of C.F.E., A.Cdre. J. Grandy. G/C. J. M. Thompson, Group Captain Ops. at C.F.E., also flew, but the formation was principally led by W/C. C. S. Scott-Vos, the commander of the Day Fighter Leader School, who was until recently O.C. Flying at Wattisham. The remainder of the team was composed of D.F.L.S. instructors S/L. E. M. Higson, S/L. C. W. Coulthard, F/L. J. J. Phipps, F/L. J. M. Nicholls, F/L. J. R. Maitland, F/L. P. Latham, and F/L. K. N. Haselwood. The Hunters were part of the equipment of D.F.L.S. and some bore the white stripes on the wings and along the dorsal spine which distinguish the machines of one of the two flights.

The route followed led from West Raynham, *via* Wahn, Fuerstenfeldbruck, Istrana (Venice), Capodichino (Naples), Brindisi, Ellenikon, and Eskesehir to Nicosia. There members of the team had staff talks, A.Cdre. Grandy returned to the U.K., and the aircraft were flown to Amman, to be entertained by the Arab Legion Air Force, and on to Habbaniyah and the Canal Zone. For the first time sonic booms were heard in that part of the world and the phenomenon aroused great interest. The flight back was along the same route, starting on August 25th, with the addition of a visit to Malta, where another exercise was held. Here the Hunters met, and in some cases had dog-fights with U.S.A.F. F-86Ds from North Africa.

These Sea Hawks from No. 800 Sqn., F.A.A., gave a display of formation aerobatics at the Naval Air Day held at R.N.A.S. Anthorn recently. Direct competitors were a team of Meteors from C.F.S.

The whole tour was the annual journey made by members of C.F.E. to fighter stations abroad which all come within their "parish." Unfortunately only six of the eight aircraft returned to C.F.E. together, since one was held up at Malta for an engine change and another had stayed to escort it back when it was ready. The engine change was, however, caused by a stone thrown up into the intake.

It had been intended that a Canberra should precede the Hunters on each leg to provide actual weather information, but this aircraft (incidentally, the only Canberra in Fighter Command; it is used as a high speed target at West Raynham) went unserviceable at Capodichino.

Ground crews, whose hard work was credited with making the tour a practical possibility, and spares were carried in a Hastings and two Valettas.

Noteworthy was the landing at West Raynham on returning. The main 2,000 yd runway was being resurfaced and, in a six-knot wind, all the Hunters put down comfortably on the subsidiary 1,500 yd runway, used normally only to avoid very strong cross-winds. All of them could have stopped comfortably before reaching the end of the short runway, despite the fact that the very minimum touch-down speed is well above that of the Meteor.

Six of the Hunter pilots after returning from the Middle East seen with A. Cdre. J. Grandy, C.F.E. Commandant (centre). They are (l. to r.) F/L. K. N. Haselwood, S/L. C. W. Coulthard, W/C. C. S. Scott-Vos, O.C., D.F.L.S., G/C. J. M. Thompson, G/C. Ops., F/L. J. J. Phipps and F/L. J. M. Nicholls. (Right) Genuine Arab headdress worn, for taxying, by F/L. K. N. Haselwood.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Radio Recollections

THE article by Mr. Oomen on MF and MF/DF [August 5th] raises some interesting points.

Firstly, what has replaced it? In the old days, one could transmit a C.Q. call in the Central Mediterranean, and receive seven or eight answers from stations as far apart as North Africa and Rome, all with a good QTE.

Theoretically VHF/DF should replace it, but, although slightly more accurate, the range is very small compared with MF, and in the same place probably only one, or at the most two, answers will be received.

Also, anyone who has experienced the excellence of MF operating finds the Continental VHF homer a sad affair.

Mr. Oomen states, "There was a certain code of good behaviour and politeness in those days." Well, I can assure him, there still is; "GM," "TU," etc., are still extensively used.

Incidentally, isn't it time that the "Technical Officer, I.C.A.O." got himself an up-to-date Q-code book?

Thorpe Bay, Essex. G. ABRAHAMS.

[We believe the author of the article was deliberately quoting decodes as used at the early period of which he was writing.—Ed.]

Hushed Helicopters

TWICE every hour throughout the day B.E.A. whirlybirds pass within a short distance of my window, their not unpleasant purring hardly disturbing me. Occasionally much louder roars join the stream, which come from the unsilenced engines of helicopters operated by the Services or the manufacturers. Unsilenced helicopters should not fly into London or other cities, as they create bad impressions. If B.E.A. can silence their helicopters then at least the makers and the Services can too—especially the makers, whose livelihood will depend on the popularity of their aircraft.

London, S.W.3. GEOFFREY DORMAN.

Memories of Cody

THE "repeat performance" by M. Jean Salis of Blériot's 1909 cross-Channel flight, and your recent reference to S. F. Cody, reminded me of an incident in my boyhood, when I saw my first "flying machine."

In the summer of 1910, I was with my grandfather in his pony trap jogging along the road from Aldershot to Fleet. Suddenly, there was a terrific clatter behind the trees on our right. My grandfather, who obviously knew what was coming, pulled up, and jumped down from his seat to grab the pony's head, as an immense contraption of struts and wires appeared over the trees. It swayed above our heads with the graceful abandon of the airborne result of an illicit union between an ancient four-poster and a chicken-house. A man, looking like a large, helmeted spider, sat at a steering wheel in what seemed to me to be a web of wires in the front of the outfit. "It's that Cody again!" roared my grandfather above the din, hanging on to his pony, which was itself excitedly trying to go skywards, and he made the name sound almost like an expletive.

Poor Cody was not always taken seriously, of course—but nobody could take his plane lightly. It weighed about one ton. It is worth remembering that Cody was the only flying man who seriously thought of making an attempt in 1909 on the London to Manchester flight, for which the *Daily Mail* was offering a prize of £10,000.

Pinner, Middx. ARTHUR W. ORD-HUME, Senr.

ON a point of interest concerning "Cody's Tree" at Farnborough, to which the late Col. S. F. Cody tethered his aeroplane in order to measure the thrust in pounds, by means of a spring balance, of the propellers at the full power of the 50 h.p. engine: it would be interesting to learn, if possible, what the thrust was of those bygone components.

Is it possible that amongst your records you may be able to enlighten me on this subject? L. J. BAYLISS, S/L. (Ret.).

Gloucester.

[Reference to early descriptions has failed to yield information of the kind required. Perhaps there are readers who can quote figures.—Ed.]

For Preparations to Attack?

THE fuselage plan of the new Lockheed Electra transport (*Flight*, July 22nd, page 116) is reminiscent of an 18th-century ship of the line. Granted that "galley" is now an accepted term for aviation use, what are those "powder rooms" for? If they are so necessary where is the stowage for round-shot, and where do the powder monkeys berth?

London, N.W.2. L. F. E. COOMBS

THE INDUSTRY IN BRIEF

Shell Chemicals Concentration

AS a result of continuous increase in the activities of the Shell Chemical Manufacturing Co., Ltd., and Shell Chemicals, Ltd., it has been decided to concentrate all Shell's chemical manufacturing and marketing in the United Kingdom and Eire in one company, to be known as the Shell Chemical Co., Ltd. The new concern, which has an authorized capital of £10m, will take over all the work of the other two. Petrochemicals, Ltd., recently acquired by Shell Chemicals, Ltd., will become a wholly owned subsidiary of the new company, but will continue as an entity.

The board of Shell Chemical Co., Ltd., will be composed of Messrs. F. A. C. Guépin (chairman), W. F. Mitchell (vice-chairman), L. H. Williams (managing director), G. H. W. Cullinan (commercial director and deputy to the managing director), E. Le Q. Herbert (executive director, manufacturing). Other directors will be Messrs J. W. Platt, Sir Robert Robinson, A. D. Koeleman, Dr. M. A. Matthews and F. Mackley.

* * *

Board changes have been announced by Bakelite, Ltd. Mr. H. V. Potter is to retire from the position of managing director at the end of October, but is to remain as chairman of the Board. Mr. F. J. Robinson will vacate the post of deputy managing director at the same time, and Mr. G. W. Hodds will become managing director from November 1st.

* * *

An agreement between the General American Transportation Corporation and Albright and Wilson, Ltd., makes the latter company sole licensees for the Kanigen chemical nickel plating process in the United Kingdom, Eire and Denmark. Kanigen plate—a nickel-phosphorus alloy containing about 8.5 per cent of phosphorus—is a new material which can be applied to metal, glass, plastics and ceramics. It is claimed to provide a uniform, hard, non-porous coating on components of any shape.

* * *

Lodge Plugs, Ltd., announce that Mr. Michael Daunt, O.B.E., has been appointed sales manager at Rugby. Mr. Daunt was formerly chief test pilot of the Gloster Aircraft Co., Ltd., and was responsible for the first flight and early development of the Meteor. The appointment follows a decision whereby Mr. B. D. Bacon, formerly general sales manager, is to continue as vice-president of the Lodge Spark Plug Co., Los Angeles.

* * *

An R.C.A.F. photographic officer for 15 years, Mr. Donald S. Ross has joined P.S.C. Applied Research, Ltd., in Toronto as projects manager in charge of photographic and optics activities.

* * *

Wickman, Ltd., of Banner Lane, Tile Hill, Coventry, are to assume sole agency for the products of Arthur Scrivener, Ltd., of Tyburn Road, Birmingham. The latter company manufacture grinding machines for various applications.

* * *

From Valay Industries, Ltd., of 186 Campden Hill Road, London, W.8, it is learned that their "Jove" Wadpol is being used by the Bristol Aeroplane Co., Ltd., for the cleaning and polishing of production Britannias.

* * *

Teddington Aircraft Controls, Ltd., Cefn Coed, Merthyr Tydfil, South Wales, are soon to issue a year book which replaces their original handbook. The publication describes the functioning of various systems for which the company manufacture controls and gives details of the various items in these systems. It will also contain technical data on other equipment designed and manufactured by the company.

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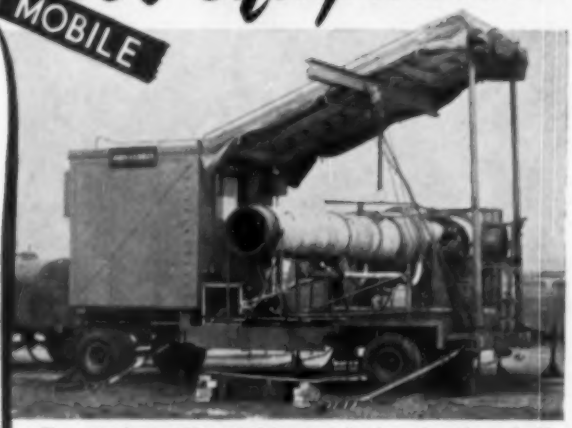

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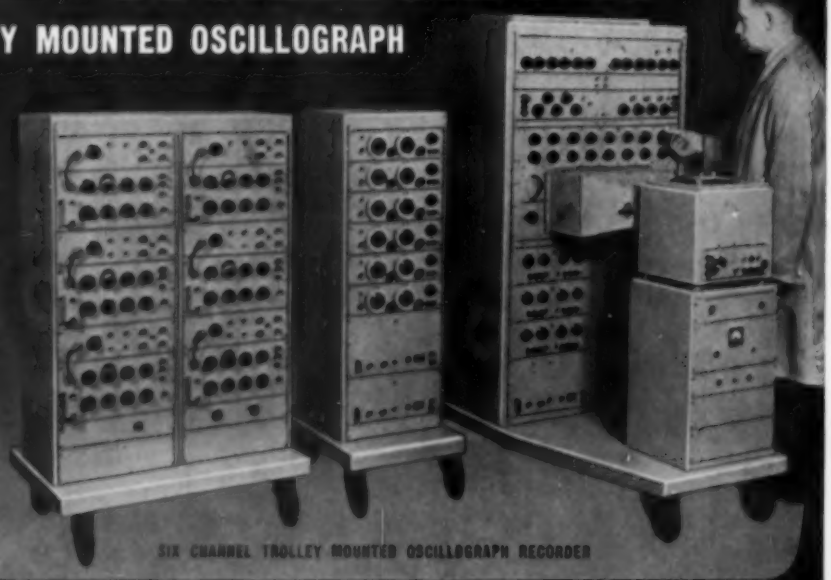

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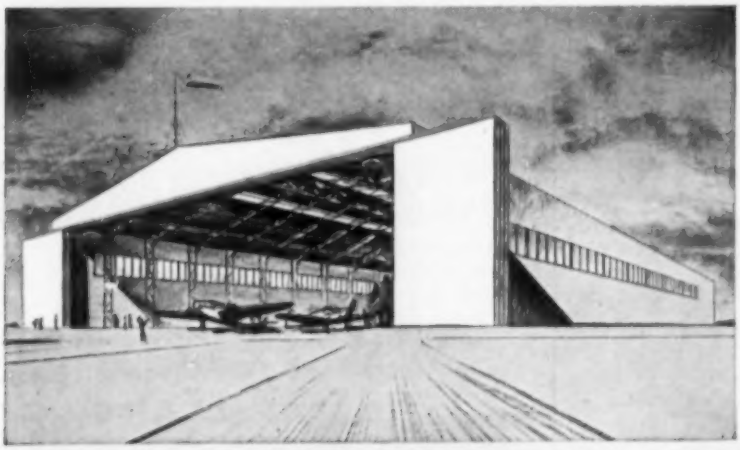

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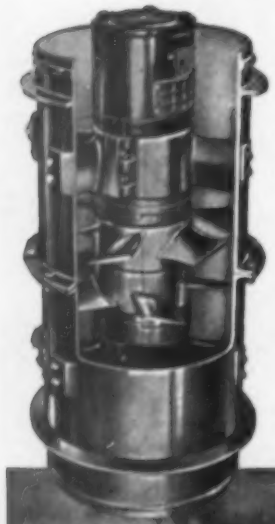

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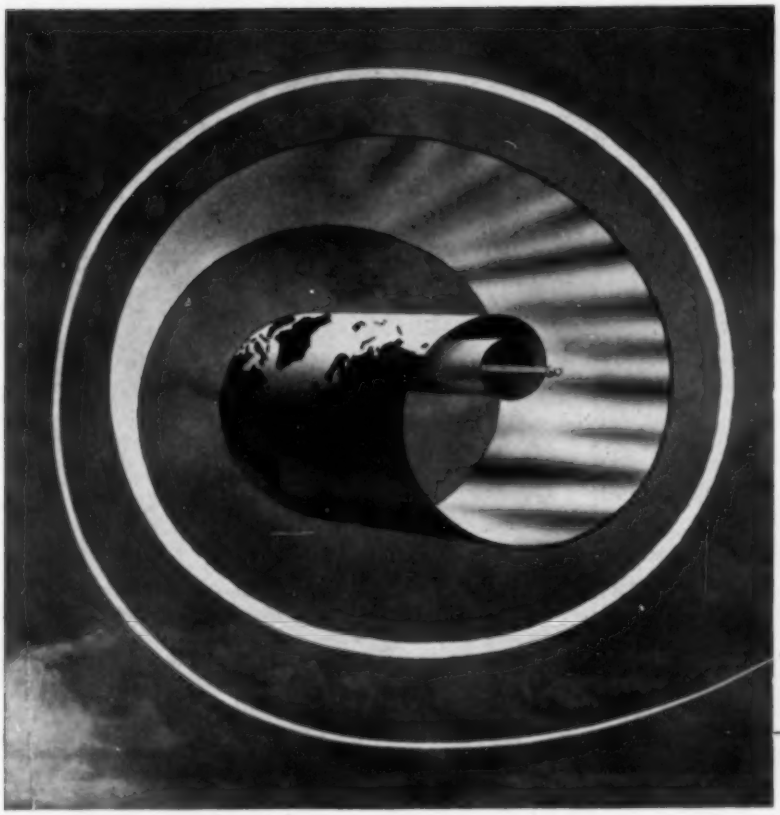

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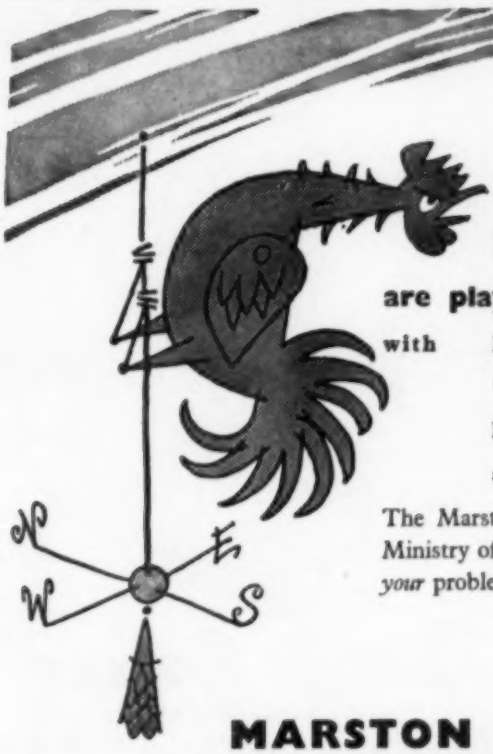

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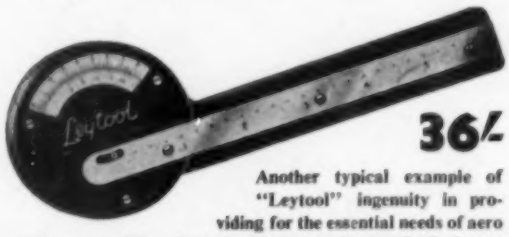

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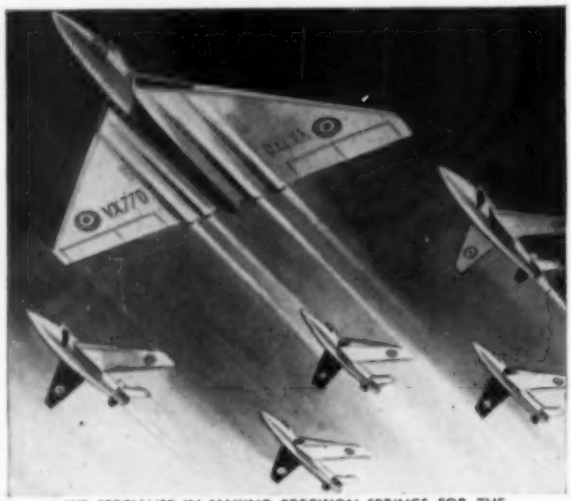

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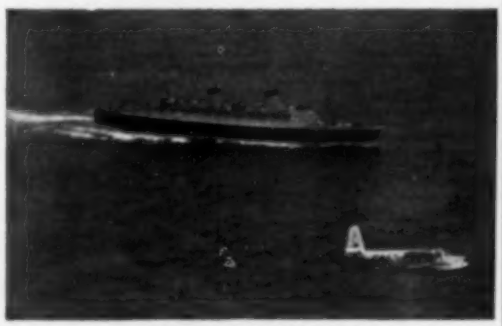

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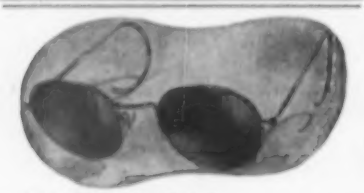

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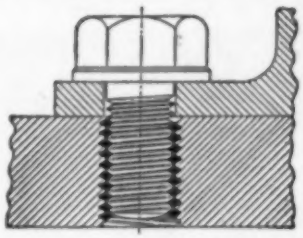

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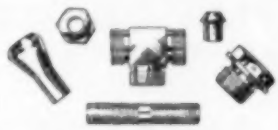

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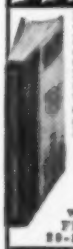

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

APPLICATION No. 12/2 from Morton Air Services Ltd. (and Olley Air Service Ltd.) of Croydon Airport, Croydon, Surrey, for an amendment to the terms of approval of the seasonal U.K. Internal Service between London (Croydon) and Jersey and Guernsey, which they operate on Fridays and Saturdays from mid June to mid September, 1959, so as to be allowed to operate also at a frequency of four return flights on Sundays from mid June to mid September, commencing 1956.

APPLICATION No. 602 from Airwork Ltd. of 15, Chesterfield Street, London, W.1, for an Inclusive Tour Service with Viking aircraft in conjunction with Horizon Holidays Ltd. between London Airport and Malaga, at a frequency of from one return flight per fortnight up to two return flights per week, operated on Fridays, for a period of seven years, commencing May, 1956.

FROM Eagle Aviation Ltd. of 29, Clarges Street, London, W.1, for the following applications for Inclusive Tour Services to be operated with Viking aircraft in conjunction with See Spain Ltd., at a frequency of one return flight per week on each service, operated on Saturdays or Sundays, during the season from May to October inclusive each year, for a period of seven years, commencing 1st May, 1956:—

APPLICATION No. 603 for a service between London (Blackbushe) and Barcelona.

APPLICATION No. 604 for a service between London (Blackbushe) and Palma.

APPLICATION No. 605 for a service between London (Blackbushe) and Perpignan.

APPLICATION No. 606 for a service between London (Blackbushe) and Milan.

APPLICATION No. 607 from Yeadon Aviation Ltd. of Yeadon Airfield, Near Leeds, for a U.K. Internal Service with DH89 and later Dakota aircraft, for the carriage of passengers, supplementary freight and mail between Leeds (Yeadon) and Exeter, with an intermediate traffic stop at Bristol, at a frequency of one to seven return flights weekly, for a period of seven years, from 1st May, 1956.

APPLICATION No. 609 from British European Airways of Keyline House, Ruislip, Middx., for permission to omit Athens from the All-Freight Service which they are authorised to operate on the route set out as Route No. 8 in Schedule 'B', Part II of the Terms of Reference, issued to the Council by the Minister of Civil Aviation on 30th July, 1952, and also to combine at their discretion the All-Freight Service so amended with their authorised All-Freight Service on the route London-Milan.

FROM East Anglian Flying Services Ltd. of Southend Airport, Essex:—

APPLICATION No. 608 for a Normal Scheduled Service for the carriage of passengers, supplementary freight and mail, to be operated with DH Dove and later possibly with Dakota and/or Prestwick Pionair aircraft, between Ipswich and Palma, with optional intermediate traffic stops at Southend, Shoreham and Barcelona, at a frequency of two to seven return flights weekly, for a period of 10 years from 1st May, 1956.

APPLICATION No. 610 for an Inclusive Tour Service to be operated in conjunction with East Anglian Flying Services Ltd. as Travel Agent, to be operated with DH Dove and later possibly with Dakota and/or Prestwick Pionair aircraft, between Ipswich and/or Southend and/or Shoreham on the one hand and Barcelona and Perpignan on the other hand, at a frequency of two to seven return flights weekly, during the season from May to October inclusive each year, for a period of 10 years from 1st May, 1956.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [4230

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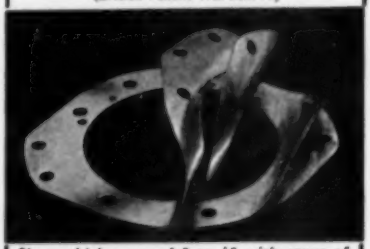

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CANDIDATES must have obtained a university degree with first or second class honours in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification; or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience.

CANDIDATES taking their degrees in 1955 may apply before the result of their degree examination is known.

AGE Limits: Senior Scientific Officers, between 26 and 31, but specially suitable candidates under 26 may be admitted; for Scientific Officers between 21 and 28 during 1955 (up to 31 for permanent members of the Experimental Officer class). Salary (London) Senior Scientific Officers: (men) £1,070-£1,245; (women) £933-£1,137. Scientific Officers: (men) £513-£925; (women) £513-£835. Women's scales subject to improvement under equal pay scheme. Somewhat lower rates in the provinces.

FURTHER particulars from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S.53/55 for Senior Scientific Officers and S.52/55 for Scientific Officers. [4225

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METEOROLOGICAL OFFICE, SCIENTIFIC OFFICERS. The Civil Service Commissioners invite applications for permanent posts. Early application is advised. The duties include research in atmospheric physics, covering the study of cloud structure, synoptic and dynamical meteorology, large and small scale diffusion and turbulence, climatology, and development of instruments. There is a limited number of posts for forecasting work at the more important centres. Successful candidates will be given a course in meteorology before being assigned to a research or forecasting establishment for further training and experience. In some instances candidates with national service obligations can be commissioned in the R.A.F. for forecasting duties at R.A.F. stations. Further information may be obtained from the Director, Meteorological Office (M.O.10), Air Ministry, Kingsway, London, W.C.2.

CANDIDATES must be between 21 and 28 during 1955 (up to 31 for permanent members of the Experimental Officer class). They must have (or obtain in Summer, 1955) a First or Second Class Honours degree preferably in physics or mathematics. Salaries £513-£925 (London rates for men; somewhat lower in the provinces). Women's scales are somewhat lower than men's but subject to improvement under equal pay scheme. Opportunities for promotion to Senior Scientific Officer (£1,070-£1,245), and higher posts.

APPLICATION forms from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S52/55. (Met.) [4214

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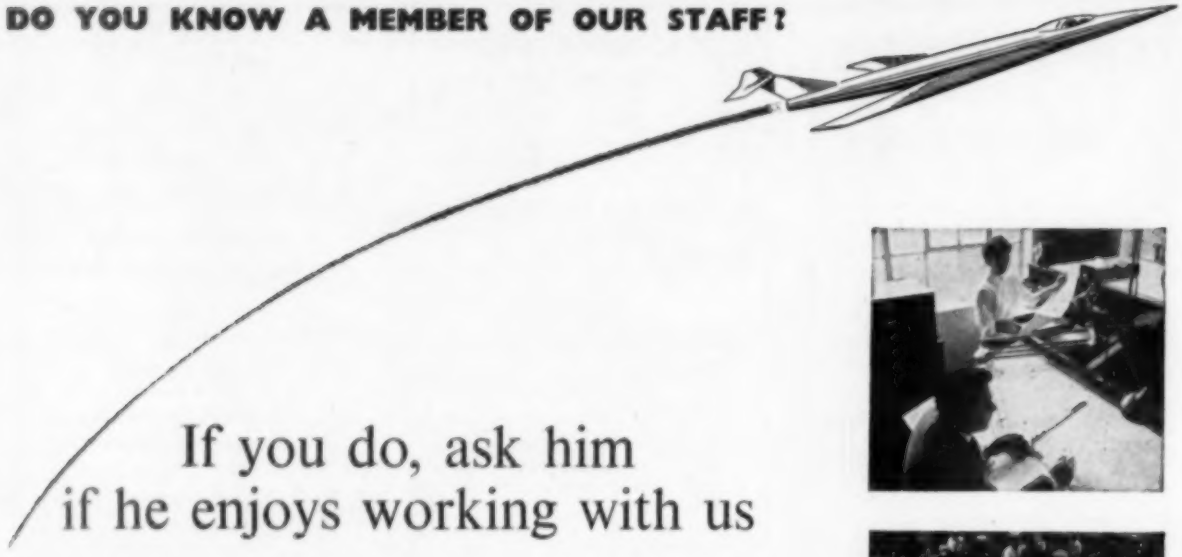

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